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RESEARCH MEMORANDUM

PERFORMANCE OF THE COMPONENTS OF THE XJ34-WE-32 TURBOJET ENGINE OVER A RANGE OF ENGINE AND FLIGHT CONDITIONS

By John E. McAulay, Adam E. Sobolewski, and Ivan D. Smith

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

RESEARCH MEMORANDUM

PERFORMANCE OF THE COMPONENTS OF THE XJ34-WE-32 TURBOJET ENGINE OVER A RANGE OF ENGINE AND FLIGHT CONDITIONS

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SUMMARY

Performance of the compressor, combustor, and turbine operating as integral parts of the XJ34-WE-32 turbojet engine was determined in the Lewis altitude wind tunnel over a wide range of flight conditions. This investigation was conducted with the electronic control inoperative.

The peak compressor efficiency decreased from about 0.84 to 0.79 as altitude was increased from 10,000 to 55,000 feet at a flight Mach number of 0.53. For all flight conditions investigated, the peak compressor efficiency occurred at a compressor pressure ratio of approximately 3.8 and a corrected air flow of 55 pounds per second. The corresponding corrected engine speed varied slightly with Reynolds number but was about 11,800 rpm. Decreasing the Reynolds number generally resulted in a decrease in compressor efficiency and corrected air flow for a given corrected engine speed and compressor pressure ratio.

Within the range of flight Mach numbers investigated, the combustion efficiency for rated engine conditions remained constant at about 0.95 to altitudes of 25,000 feet and decreased to about 0.80 at an altitude of 55,000 feet.

Changes in exhaust-nozzle area or flight Mach number had no discernible effect on turbine efficiency. Within the range of corrected turbine speeds encountered during engine operation, the change in turbine efficiency was small. At rated engine conditions, the turbine efficiency decreased from about 0.86 to 0.82 as the altitude was increased from 10,000 to 55,000 feet.

INTRODUCTION

An investigation was conducted in the NACA Lewis altitude wind tunnel to determine the altitude performance characteristics of the XJ34-WE-32 turbojet engine. In conjunction with these over-all engine performance data, component performance data were obtained for each of four exhaust-nozzle areas over a range of altitudes from 5000 to 55,000 feet and flight Mach numbers from 0.28 to 1.05. At each flight condition and exhaust-nozzle area, data were obtained over an extensive range of engine speeds.

Performance data of the compressor, combustor, and turbine are presented herein in graphical form to show the effects of changes in flight and engine conditions. A compressor map is presented for each flight condition investigated. For the combustor and turbine, only typical performance data are shown. All data obtained are presented in tabular form.

APPARATUS

Engine Components

The XJ34-WE-32 turbojet engine used in this investigation (fig. 1) has a static sea-level thrust rating of 3370 pounds (afterburner inoperative) at an engine speed of 12,500 rpm and a turbine-inlet temperature of 1525° F. The engine is equipped with an afterburner and an electronic control which were inoperative during this investigation.

Compressor. - The eleven-stage axial-flow compressor has a single row of inlet guide vanes, a double row of outlet guide vanes, and a single row of mixer vanes. The compressor rotor is shown in figure 2. The blade-tip diameter of the eleven-stage rotor section is 18.91 inches and the blade height varied from 4.71 inches at the first stage to 2.46 inches at the eleventh stage. The compressor air flow is about 58 pounds per second at rated static sea-level conditions.

Combustor. - The combustor (fig. 3) is of the annular direct-flow type with a double-annular basket that merges into a single annulus near the downstream end. Two concentric fuel manifold rings, with 24 and 36 matched fuel nozzles at the inner and outer rings, respectively, are located at the upstream end of the double-annular basket.

Turbine. - The two-stage axial-flow turbine has a blade height of about 3.9 inches for both rotor stages and a blade tip diameter of 20.81 inches. The turbine rotor is shown in figure 4.

Installation and Instrumentation

The engine was mounted on a wing segment in the 20-foot-diameter test section of the altitude wind tunnel. Dry refrigerated air was supplied to the engine inlet through a duct from the tunnel make-up air system. This air was throttled from approximately sea-level pressure to an engine-inlet total pressure corresponding to the desired flight condition.

Location of the instrumentation used to determine component performance is shown in figure 5. The temperatures measured at the exhaust-nozzle inlet (station 7) were used as the turbine-outlet temperatures because of the effect of radiation on the temperatures measured at station 5.

PROCEDURE

Dry refrigerated air was supplied to the engine at the NACA standard temperature for each flight condition except that the minimum temperature obtained was about -20° F. The data at an altitude of 5000 feet were obtained using an inlet temperature that was required to give a Reynolds number index of 1.00. Complete free-stream ram pressure recovery was assumed at each flight condition.

The following table indicates the flight conditions at which data were obtained:

Altitude (ft)	Flight Mach number			
	0.28	0.53	0.79	1.05
5,000	x			
10,000		x		
25,000	x	x	x	x
40,000		x	x	x
47,000		x		
55,000		x	x	

At each of these flight conditions, data were obtained over a range of engine speeds from about 6250 to 12,500 rpm at four fixed positions of the variable-area exhaust nozzle (projected exhaust-nozzle areas from 1.063 to 1.902 sq ft) except when instrumentation difficulties were encountered or when the engine operation was limited by either excessive exhaust-gas temperature, combustor blow-out, or compressor surge.

Data were not obtained because of instrumentation difficulties at the following flight conditions: at altitude of 5000 feet, flight Mach number of 0.28, and exhaust-nozzle area of 1.063 square feet for several intermediate engine speeds between 6250 and 12,500 rpm; at altitude of 25,000 feet, flight Mach number of 1.05, and exhaust-nozzle area of 1.902 square feet. Limiting exhaust-gas temperature prevented data from being taken at rated engine speed with an exhaust-nozzle area of 1.063 square feet at any flight condition investigated. Within the range of flight Mach numbers investigated, combustor blow-out occurred at low engine speeds above an altitude of 40,000 feet. Compressor surge occurred in the medium engine speed range (corrected engine speeds greater than 10,000 rpm and less than 12,000 rpm) with the small exhaust-nozzle area. At and below altitudes of 25,000 feet and at the two highest flight Mach numbers investigated at an altitude of 40,000 feet, the instabilities caused by compressor surge were small and the exhaust-gas temperatures were not excessive. It was therefore possible to obtain some data at these flight conditions in the region of compressor surge.

The symbols and the methods of calculation used herein are given in appendixes A and B, respectively.

RESULTS AND DISCUSSION

Compressor Performance

In order to simplify the following discussion, an engine operating point is defined by a given corrected engine speed and exhaust-nozzle area; and a compressor operating point, by a given corrected engine speed and compressor pressure ratio.

Compressor performance maps. - Compressor performance maps for each flight condition investigated are presented in figure 6 where compressor pressure ratio is plotted against corrected air flow with lines of constant corrected engine speed, compressor efficiency, and exhaust-nozzle area.

Except near the region of compressor surge, increasing the altitude from 10,000 to 25,000 feet at a flight Mach number of 0.53 had no appreciable effect on engine operating points, but a further increase in altitude shifted engine operating points at high corrected engine speeds to higher compressor pressure ratios and lower corrected air flows on the compressor map (figs. 6(b), 6(e), 6(i), 6(j), and 6(l)). At low corrected engine speeds the shift in engine operating points was to lower corrected air flows with no distinguishable change in compressor pressure ratio.

The decrease in corrected air flow along with a decrease in compressor efficiency was due to a decrease in Reynolds number as altitude was increased. The lower compressor efficiency required the turbine to produce more work per pound of gas to maintain a given corrected engine speed. This requirement was met by operating at a higher turbine-inlet temperature. In order to satisfy the condition of continuity, engine operating points at high corrected engine speeds shifted to higher compressor pressure ratios. Apparently, this condition was satisfied at low corrected engine speeds without an increase in compressor pressure ratio.

Except near the region of compressor surge, decreasing the flight Mach number from 1.05 to 0.28 at an altitude of 25,000 feet (figs. 6(c) to 6(f)) shifted engine operating points at high corrected engine speeds to higher compressor pressure ratios with no appreciable change in corrected air flow. At low corrected engine speeds, engine operating points shifted to higher compressor pressure ratios and lower corrected air flows on the compressor map. The increase in compressor pressure ratio is attributed to a decrease in the energy of the inlet air as flight Mach number was decreased, requiring that the turbine produce more work (higher turbine-inlet temperature) per pound of gas in order to maintain a given corrected engine speed. The amount the corrected air flow decreased depended on the slope of the compressor characteristic and the magnitude of the increase in compressor pressure ratio. At high corrected engine speeds, the corrected air flow did not change appreciably because the compressor characteristic was nearly vertical; whereas at low corrected engine speeds, the corrected air flow decrease was primarily due to a decrease in the slope of the compressor characteristic curve.

The peak compressor efficiency decreased from about 0.84 to 0.79 as altitude was increased from 10,000 to 55,000 feet at a flight Mach number of 0.53. For all flight conditions investigated, the peak compressor efficiency occurred at a compressor pressure ratio of approximately 3.8 and a corrected air flow of 55 pounds per second. At high Reynolds numbers (altitudes of 25,000 feet and less), this compressor pressure ratio and corrected air flow corresponded to a corrected engine speed of about 11,800 rpm; at low Reynolds numbers the corresponding corrected engine speed was somewhat higher.

As corrected engine speed was increased above the value at which peak compressor efficiency was encountered, the compressor efficiency decreased at a greater rate. This decrease in compressor efficiency is attributed to mismatching of the compressor stages, which resulted from the compressibility and boundary-layer effects that could not be completely accounted for in the compressor design. Therefore, if the engine were operated at rated engine speed above the tropopause, the corrected engine speed would be above 13,100 rpm at any flight Mach number of 1.00 or less and the compressor would be operating in a region of compressor efficiency considerably below the peak value. For example, by extrapolating the data available at an altitude of 40,000 feet at a flight Mach number of 0.53 and an exhaust-nozzle area of 1.138 square feet, the compressor efficiency would be expected to decrease from about 0.81 to 0.73 or less as corrected engine speed was increased from 12,500 to 14,000 rpm.

As stated previously, several data points were obtained when the compressor was in a mild surge. The data presented in figure 6(f) are a good example of how the compressor performance map is affected by compressor surge. At a corrected engine speed of 11,000 rpm the compressor characteristic curve assumed a positive slope as the exhaust-nozzle area was decreased. Positive slope of the compressor characteristic is associated with compressor surge (reference 3). A significant decrease in compressor efficiency also occurred when the compressor was operated in the surge region.

The increasing effect of surge on the compressor performance (figs. 6(b) and 6(e)) and the absence of performance data at the small exhaust-nozzle area (figs. 6(i), 6(j), and 6(l)) indicate that at a given flight Mach number an increase in altitude resulted in increasing restriction by compressor surge of the steady-state operating region. At a given altitude, decreasing the flight Mach number resulted in a similar effect, as shown by figures 6(g) through 6(i). It is therefore concluded that the steady-state operating region moved closer to the surge line as a result of an increase in altitude or a decrease in flight Mach number.

Reynolds number effect on compressor operating points. - The effect of Reynolds number on several compressor operating points is presented in figure 7. For a given compressor operating point, decreasing the Reynolds number generally resulted in a decrease in compressor efficiency and corrected air flow. For example, as Reynolds number index is decreased from 1.00 to 0.17 at a corrected engine speed of 12,500 rpm and a compressor pressure ratio of 4.2, the corrected air flow decreases from 58.0 to 57.0 pounds per second and the compressor efficiency decreases from 0.835 to 0.796. This decrease in Reynolds number index corresponds to an increase in altitude from about 10,000 to 55,000 feet at a flight Mach number of 0.80.

The effect of operating the engine at rated speed at high altitudes was discussed previously. If, therefore, the engine is operated at rated speed at a given flight Mach number and the altitude is increased, the compressor efficiency will decrease because of both decreased Reynolds number at high altitude and mismatching of the compressor stages at high corrected speeds.

Combustor Performance

Combustion efficiency. - Typical effects of altitude, flight Mach number, and exhaust-nozzle area on combustion efficiency are presented in figures 8, 9, and 10, respectively, where combustion efficiency is plotted against corrected engine speed. The primary variables affecting combustion efficiency are fuel atomization (measured roughly by fuel flow, which determines the pressure difference across the fuel nozzles), fuel-air ratio, and combustor-inlet pressure, temperature, and velocity. As it was impossible to independently control these variables when the combustor was operating as an integral part of a turbojet engine, the data do not lend themselves to presentation using the aforementioned variables. By changing engine speed, altitude, flight Mach number, and exhaust-nozzle area, the primary variables affecting combustion efficiency were all changed varying degrees. For example, as the altitude was increased at a given corrected engine speed, flight Mach number, and exhaust-nozzle area, the fuel-air ratio increased, the combustor-inlet pressure and the fuel flow decreased, and there was a negligible change in combustor-inlet temperature and velocity. The increase in combustion efficiency due to increased fuel-air ratio was small compared with the decrease in combustion efficiency which resulted from the decrease in combustor-inlet pressure and fuel flow. The net result was a reduction in combustion efficiency as altitude was increased.

A combination of curves similar to those of figures 8, 9, and 10 or the data of table I indicate that when the engine was operated at rated conditions within the flight Mach numbers investigated, the combustion efficiency remained constant at about 0.95 up to an altitude of 25,000 feet and decreased to about 0.80 at an altitude of 55,000 feet.

Combustor total-pressure loss. - Representative data for various flight conditions and exhaust-nozzle areas are plotted in figure 11 to show combustor total-pressure loss coefficient as a function of combustor total-temperature ratio. The combustor total-pressure loss is a sum of the friction loss and the momentum loss. When the combustor temperature ratio is equal to unity, the entire total-pressure loss through the combustor is due to friction. The data of figure 11 can therefore be extrapolated to a combustor total-temperature ratio of 1, which gives a combustor total-pressure loss coefficient due to friction of 2.9. The method of calculating the combustor dynamic pressure is given in appendix B. Values of both combustor total-pressure loss coefficient and combustor total-pressure loss ratio are given in table I.

Turbine Performance

Turbine speed corrected to turbine-inlet temperature is plotted against corrected engine speed in figure 12 showing typical trends with altitude, flight Mach number, and exhaust-nozzle area. The primary purpose of this figure is to serve as a connecting link between engine operation and turbine performance, which can be better shown when plotted against corrected turbine speed.

Turbine pressure ratio. - The effect of corrected turbine speed, exhaust-nozzle area, flight Mach number, and altitude on turbine pressure ratio is presented in figure 13. The effects shown are due to changes in the matched operation of the turbine and compressor at various steady-state conditions. When the engine was operating at rated conditions the turbine pressure ratio was approximately 2.0.

Turbine efficiency. - The effect of corrected turbine speed, exhaust-nozzle area, flight Mach number, and altitude on turbine efficiency is presented in figure 14. The data of figures 14(a) and 14(b) indicate that within the accuracy of the data there was no discernible effect of exhaust-nozzle area or flight Mach number on turbine efficiency. Similar plots at other flight conditions agree with this conclusion. Within the range of corrected turbine speeds encountered during engine operation, the change in turbine efficiency was small.

At the corrected turbine speed that corresponded to rated engine conditions (about 6400 rpm), the turbine efficiency decreased from about 0.86 to 0.82 as altitude was increased from 10,000 to 55,000 feet (fig. 14(c)). As shown in figure 13(c), the same change in altitude resulted in a small increase in turbine pressure ratio at any given corrected turbine speed. Similar changes in turbine pressure ratio obtained by changing exhaust-nozzle area or flight Mach number had no apparent effect on turbine efficiency (figs. 14(a) and 14(b)). This decrease in turbine efficiency with increasing altitude may therefore be associated with a decrease in Reynolds number.

Corrected turbine gas flow. - The effect of corrected turbine speed, exhaust-nozzle area, flight Mach number, and altitude on corrected turbine gas flow is presented in figure 15. Some inconsistencies which could not be explained existed in the values of corrected turbine gas flow. Within the accuracy of the data, however, there was no effect of exhaust-nozzle area, flight Mach number, or altitude on corrected turbine gas flow. At corrected turbine speeds above 6800 rpm the corrected turbine gas flow was constant at 29.8 pounds per second, indicating choking in the turbine.

SUMMARY OF RESULTS

The following results were obtained from an investigation of the performance of the components operating as integral parts of an XJ34-WE-32 turbojet engine in the Lewis altitude wind tunnel:

1. The peak compressor efficiency decreased from about 0.84 to 0.79 as altitude was increased from 10,000 to 55,000 feet at a flight Mach number of 0.53.

2. At all flight conditions investigated the peak compressor efficiency occurred at approximately a compressor pressure ratio of 3.8 and a corrected air flow of 55 pounds per second. At high Reynolds numbers

(altitudes of 25,000 feet and less) this compressor pressure ratio and corrected air flow corresponded to a corrected engine speed of about 11,800 rpm, whereas at low Reynolds numbers the corresponding corrected speed was somewhat higher.

3. If the engine were operated at rated speed above the tropopause at or below flight Mach number of 1.0, the compressor would be operating in a region of compressor efficiency considerably below the peak value.

4. The steady-state operating region moved closer to the surge line as a result of an increase in altitude or a decrease in flight Mach number.

5. For a given compressor operating point, decreasing the Reynolds number generally resulted in a decrease in compressor efficiency and corrected air flow. Thus, as Reynolds number index was decreased from 1.00 to 0.17 at a corrected engine speed of 12,500 rpm and a compressor pressure ratio of 4.2, the corrected air flow decreased from 58.0 to 57.0 pounds per second and the compressor efficiency decreased from 0.835 to 0.796. This decrease in Reynolds number index corresponds to an increase in altitude from about 10,000 to 55,000 feet at a flight Mach number of 0.80.

6. For rated engine conditions within the range of flight Mach numbers investigated, the combustion efficiency remained constant at about 0.95 up to an altitude of 25,000 feet and decreased to about 0.80 at an altitude of 55,000 feet.

7. Changes in exhaust-nozzle area or flight Mach number had no discernible effect on turbine efficiency. Within the range of corrected turbine speeds encountered during engine operation, the change in turbine efficiency was small. At rated engine conditions, the turbine efficiency decreased from about 0.86 to 0.82 as altitude was increased from 10,000 to 55,000 feet.

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APPENDIX A

SYMBOLS

The following symbols are used in this report:

A	cross-sectional area, sq ft
c_p	specific heat at constant pressure, Btu/(lb)(°F)
g	acceleration due to gravity, 32.2 ft/sec^2
M	Mach number
N	engine speed, rpm
P	total pressure, lb/sq ft absolute
p	static pressure, lb/sq ft absolute
q	theoretical dynamic pressure at combustor inlet, lb/sq ft absolute
R	gas constant, 53.4 ft-lb/(lb)(°R)
T	total temperature, °R
t	static temperature, °R
W_a	air flow, lb/sec
W_f	fuel flow, lb/hr
W_g	gas flow, lb/sec
γ	ratio of specific heats
δ	pressure correction factor, $P/2116$ (total pressure divided by NACA standard sea-level pressure)
η	efficiency
μ	absolute viscosity, lb-sec/ft^2
θ	temperature correction factor, $\gamma T/(1.4)(519)$ (product of γ and total temperature divided by product of γ at standard NACA sea-level temperature and standard NACA sea-level temperature)
ϕ	viscosity factor, μ/μ_0 (viscosity divided by NACA standard sea-level viscosity)

Subscripts:

0	free-stream conditions
1	inlet duct at frictionless slip joint
2	compressor inlet
3	compressor outlet, combustor inlet
4	combustor outlet, turbine inlet
5	turbine outlet
7	exhaust-nozzle inlet
b	burner
c	compressor
t	turbine

APPENDIX B

METHODS OF CALCULATION

Air flow. - Air flow was calculated at station 2 by use of the following equation:

$$W_{a,2} = p_2 A_2 \sqrt{\frac{2\gamma_2 g}{(\gamma_2-1) Rt_2}\left[\left(\frac{P_2}{p_2}\right)^{\frac{\gamma_2-1}{\gamma_2}} - 1\right]}$$

Air flow at the other stations in the engine was considered the same as that at station 2. The gas flow downstream of the combustor is

$$W_g = W_{a,2} + \frac{W_f}{3600}$$

Reynolds number index. - For a given compressor Mach number (corrected engine speed) Reynolds number index varies linearly with Reynolds number and is defined as the ratio of Reynolds number at altitude to Reynolds number at standard sea-level conditions.

$$\text{Re index} = \frac{\delta_2}{\phi_2\sqrt{\theta_2}}$$

Combustor dynamic pressure. - In order to calculate a combustor dynamic pressure, based on a cross-sectional area of 1.78 square feet, a combustor Mach number was first calculated with the equation

$$\frac{M_b}{\left(1 + \frac{\gamma_3-1}{2} M_b^2\right)^{\frac{\gamma_3+1}{2(\gamma_3-1)}}} = \frac{W_{a,3}\sqrt{T_3}}{0.776\, A_b P_3 \sqrt{\gamma_3}}$$

then

$$q = \frac{\gamma_3}{2} p_3 M_b^2$$

and

$$p_3 = \frac{P_3}{\left(1 + \frac{\gamma_3 - 1}{2} M_b^{\,2}\right)^{\frac{\gamma_3}{\gamma_3 - 1}}}$$

therefore

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$$q = \frac{\gamma_3}{2} P_3 \frac{M_b^{\,2}}{\left(1 + \frac{\gamma_3 - 1}{2} M_b^{\,2}\right)^{\frac{\gamma_3}{\gamma_3 - 1}}}$$

where

$$\gamma_3 = 1.40$$

Turbine-inlet temperature. - Turbine-inlet temperature was calculated from the following equation, which assumes compressor and turbine work equal:

$$T_4 = \frac{W_{a,2}}{W_{g,4}} \frac{c_{p,c}}{c_{p,t}} \left[T_3 - T_2\right] + T_7$$

REFERENCES

1. Bullock, R. O., and Finger, H. B.: Compressor Surge Investigated by NACA. SAE Jour., vol. 59, no. 9, Sept. 1951, pp. 42-45.

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TABLE I - COMPONENT PERFORMANCE

(a) Exhaust-nozzle area,

Run	Altitude (ft)	Ram pressure ratio P_2/p_0	Flight Mach number M_0	Tunnel static pressure p_0 (lb/sq ft abs)	Reynolds number index $\delta_2/\varphi_2\sqrt{\theta_2}$	Engine speed N (rpm)	Fuel flow W_f (lb/hr)	Compressor inlet total pressure P_2 (lb/sq ft abs)	Compressor inlet total temperature T_2 (°R)	Compressor outlet total pressure P_3 (lb/sq ft abs)	Compressor outlet total temperature T_3 (°R)	Turbine inlet total pressure P_4 (lb/sq ft abs)	Turbine inlet total temperature T_4 (°R)	Turbine outlet total pressure P_5 (lb/sq ft abs)	Exhaust gas total temperature T_7 (°R)
1	5000	1.062	0.[illegible]	1754	0.[illegible]	11,[illegible]	3470	1853	[illegible]	[illegible]	756	7710	1961	4014	1711
2		1.076	.312	1757	1.006	11,[illegible]	3405	1858	487	—	—	—	—	3387	1601
3		1.057	.276	1760	1.009	10,857	2410	1857	486	6347	706	6167	1722	3391	1623
4		1.054	.276	1754	1.005	9820	1635	1850	467	—	—	—	—	2606	1377
5		1.058	.276	1754	1.008	7805	1280	1850	466	—	—	—	—	2203	1286
6		1.0[illegible]	.276	1752	1.00[illegible]	[illegible]	[illegible]	1846	489	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1214
7	10,000	1.211	0.[illegible]	1450	0.[illegible]	11,[illegible]	[illegible]	1750	[illegible]	6715	[illegible]	[illegible]	[illegible]	[illegible]	1710
8		1.212	.594	1459	.5811	11,[illegible]	2795	1758	509	6741	781	6542	1822	3494	1630
9		1.218	.594	1450	.5807	11,[illegible]	2790	1749	507	4705	780	[illegible]	1662	3414	1622
10		1.213	.597	1454	.5795	10,857	1950	1757	500	6449	730	[illegible]	1701	2647	1486
11		1.2[illegible]	.518	1457	.5554	10,857	1856	1760	505	6811	742	6128	1711	2743	1508
12		1.205	.5[illegible]	1454	.5547	10,857	1850	1761	507	5564	744	5577	1711	2764	1508
13		1.206	.5[illegible]	1454	.5578	10,857	1350	1761	505	5068	742	5087	1709	2762	1425
14		1.208	.594	1457	.5[illegible]	9820	1305	1765	505	4018	696	3880	1460	[illegible]	1305
15		1.208	.565	1459	.5575	9820	1300	1766	506	4000	696	3861	1457	2261	1286
16		1.207	.580	1458	.5450	9820	1281	1780	510	4005	690	3875	1458	2758	1311
17		1.212	.581	1454	.5[illegible]	7805	1006	1762	507	3118	625	3019	1278	1941	1180
18		1.208	.594	1450	.5616	7805	1005	1748	499	3143	631	3048	1280	1946	1157
19		1.218	.598	1455	.5544	7805	1000	1758	507	3188	636	3036	1283	1939	1165
20		1.207	.581	1454	.5676	7805	965	1752	506	3117	636	3029	1278	1943	1153
21		1.214	.598	1450	.5560	6254	756	1754	506	2879	582	2507	1082	1707	1024
22		1.212	.581	1456	.5757	6254	780	1762	501	[illegible]	576	2514	1076	1718	1009
23		1.206	.585	1454	.5467	6254	770	1758	511	2851	587	2593	1100	1706	1039
24		1.2[illegible]	.5[illegible]	1450	.5505	[illegible]	7[illegible]	1748	509	2871	[illegible]	[illegible]	—	1710	—
25	25,000	2.0[illegible]	1.0[illegible]	784	—	11,[illegible]	[illegible]	1592	—	6144	[illegible]	[illegible]	—	—	—
26		2.061	1.062	781	—	11,654	2455	1592	—	6154	606	6641	—	—	—
27		2.028	1.052	784	.7580	11,654	2580	1577	545	6154	616	5861	1958	3086	1707
28		2.037	1.055	788	.7408	11,626	2576	1580	[illegible]	5814	602	5454	1850	2801	1616
29		2.050	1.064	779	.7515	10,857	1480	1571	526	4513	704	4343	1536	2056	1336
30		2.040	1.059	784	.7435	9820	943	1580	524	3094	[illegible]	3063	1180	1642	1001
31		2.061	1.064	780	.7494	7805	868	1582	527	2812	636	2804	971	1665	788
32		2.010	1.048	786	.7396	6256	500	1576	524	1812	578	1634	886	1026	672
33		1.582	.782	783	.6187	11,960	2269	1184	456	6109	764	4814	2030	2567	1780
34		1.530	.786	781	.6143	11,654	2250	1167	454	5057	751	4906	2087	2524	1756
35		1.519	.781	786	.6127	11,[illegible]	2018	1164	454	4761	755	4439	1856	2408	1666
36		1.565	.784	784	.6165	10,857	1356	1166	453	3815	717	3679	1617	1890	1413
37		1.565	.786	782	.6205	9820	965	1157	451	2743	656	2654	1365	1448	1126
38		1.540	.790	784	.6158	7805	745	1160	452	2061	606	1966	1062	1170	942
39		1.566	.800	781	.6148	6254	570	1193	456	1443	645	1386	813	972	748
40		1.221	.536	780	.5376	11,660	1801	861	455	4666	744	4076	1974	2145	1734
41		1.218	.532	779	.533	11,626	1659	844	453	4114	737	3679	1934	[illegible]	1636
42		1.222	.541	781	.5360	11,380	1726	852	454	3730	722	3534	2070	1866	1637
43		1.212	.508	784	.5299	10,857	1336	844	457	3301	702	3141	1729	1705	1517
44		1.214	.535	779	.5360	9820	940	845	451	2414	654	2319	1650	1336	1280
45		1.205	.586	784	.5550	7805	773	845	456	1639	606	1784	1339	1307	1115
46		1.202	.520	781	.5506	6256	657	839	453	1434	545	1574	1080	964	1310
47		1.080	.287	781	.4708	11,585	1700	850	452	3597	749	3549	2011	1807	1773
48		1.086	.296	787	.4704	11,585	1675	832	453	3370	741	3575	2010	1552	1764
49		1.081	.290	784	.4738	10,868	1574	831	450	3309	710	3140	1626	1645	1604
50		1.089	.287	783	.4731	10,557	1243	828	450	2638	730	2544	2010	1408	1761
51		1.086	.287	781	.4660	9820	880	827	449	2116	644	2060	1674	1150	1415
52		1.086	.280	780	.4656	7805	746	824	455	1678	595	1586	1430	1031	1308
53		1.0[illegible]	.276	780	—	[illegible]	[illegible]	[illegible]	—	1278	—	1440	—	—	—
54	40,000	2.0[illegible]	1.0[illegible]	[illegible]	0.4[illegible]	11,[illegible]	[illegible]	7[illegible]	477	[illegible]	772	[illegible]	[illegible]	1700	1762
55		2.038	1.062	393	.4106	11,526	1410	781	484	[illegible]	772	3108	1852	1627	1718
56		2.041	1.066	391	.4127	11,526	1399	782	482	—	768	—	1948	1622	1707
57		2.057	1.069	390	.4136	10,857	935	787	483	2466	716	2570	1809	1284	1400
58		2.043	1.068	393	.4166	9820	780	800	481	1787	652	1697	1210	918	1064
59		2.064	1.069	391	.4214	7805	570	800	478	1283	586	1196	800	640	782
60		1.567	.619	384	.3416	10,857	654	806	451	2002	709	1944	1782	1014	1749
61		1.515	.781	386	.3386	10,857	674	806	448	2004	701	1982	1784	1020	1664
62		1.589	.790	385	.3397	10,072	702	806	456	1806	678	1764	1680	926	1528
63		1.[illegible]	.800	384	.3382	9220	675	800	455	1679	651	1430	1530	768	1160
64		1.[illegible]	.794	384	.3370	7805	575	807	455	1069	576	747	1052	616	936
65		1.580	.796	386	.3548	6254	486	806	456	702	582	737	8[illegible]	506	781
66		1.205	.524	383	.3065	10,072	660	476	458	1438	621	1394	1865	756	1460
67		1.206	.524	383	.3080	10,072	680	474	451	1436	580	1324	1710	703	1514
68		1.205	.524	384	.2704	9220	632	475	450	1212	538	1108	1495	650	1328
69		1.202	.524	381	.2678	7805	570	471	452	913	500	806	1308	580	1180
70		1.191	.512	382	.2651	6250	488	470	453	661	547	666	1170	488	1081

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DATA FOR XJ34-WE-32 TURBOJET ENGINE

1.0[illegible] square feet.

Engine inlet air flow $W_{a,2}$ (lb/sec)	Corrected engine inlet air flow $W_{a,2}\sqrt{\theta_2}/\delta_2$ (lb/sec)	Corrected engine speed $N/\sqrt{\theta_2}$ (rpm)	Compressor Mach number M_c	Compressor total-pressure ratio P_3/P_2	Adiabatic compressor efficiency η_c	Fuel-air ratio $W_f/3600\,W_{a,2}$	Combustor total-pressure loss coefficient $(P_3-P_4)/q_3$	Combustor total-pressure loss ratio $(P_3-P_4)/P_3$	Combustor total-temperature ratio T_4/T_3	Combustor efficiency η_b	Corrected turbine speed $N/\sqrt{\theta_4}$ (rpm)	Corrected turbine gas flow $W_{g,4}\sqrt{\theta_4}/\delta_4(\gamma_4/1.4)$ (lb/sec)	Turbine total-pressure ratio P_4/P_5	Adiabatic turbine efficiency η_t	Run
[illegible]	57.80	12,297	0.908	4.881	0.843	0.0182	3.127	0.0280	2.881	0.848	8281	29.64	1.981	0.843	1
[illegible]	57.06	12,147	.897	—	—	.0175	—	—	—	.858	—	—	—	—	2
45.43	48.08	11,117	.821	3.416	.818	.0147	3.131	.0288	2.485	.862	8626	29.74	1.854	.850	3
34.36	37.31	9718	.717	—	—	.0132	—	—	—	.932	—	—	—	—	4
[illegible]	30.38	8308	.618	—	—	.0121	—	—	—	.904	—	—	—	—	5
[illegible]	[illegible]	[illegible]	.486	1.612	[illegible]	.0114	[illegible]	[illegible]	[illegible]	[illegible]	4034	[illegible]	[illegible]	[illegible]	6
[illegible]	[illegible]	11,[illegible]	0.[illegible]	[illegible]	0.843	0.0178	[illegible]	0.[illegible]	2.431	0.[illegible]	8137	29.30	1.861	0.[illegible]	7
45.36	54.11	11,840	.908	3.338	.847	.0171	3.128	.0288	2.430	.867	8178	29.62	1.904	.838	8
45.37	54.14	11,843	.881	3.434	.840	.0171	3.188	.0301	2.446	.965	8162	29.41	1.905	.834	9
36.78	45.77	10,787	.785	3.101	.805	.0148	3.383	.0334	2.305	.946	8077	29.32	1.880	.839	10
37.87	45.08	10,688	.788	3.036	.785	.0142	3.376	.0326	2.303	.888	8063	29.41	1.848	.844	11
37.36	44.81	10,683	.787	2.986	.788	.0143	3.300	.0318	2.320	.867	8083	29.45	1.838	.851	12
37.77	48.02	10,[illegible]	.788	3.079	.788	.0141	3.381	.0327	2.334	.888	8073	29.57	1.815	.848	13
30.58	36.38	9349	.690	2.388	.748	.0119	3.182	.0336	2.188	.888	8015	28.90	1.712	.830	14
30.46	36.37	9340	.690	2.383	.763	.0118	3.303	.0348	2.134	.885	8085	28.91	1.715	.841	15
[illegible]	[illegible]	9303	.687	2.389	.787	.0120	3.188	.0325	2.188	.884	8096	28.41	1.715	.834	16
[illegible]	29.08	7898	.581	1.769	.708	.0114	3.080	.0331	2.014	.788	8120	27.72	[illegible]	.848	17
[illegible]	29.75	8041	.585	1.786	.581	.0112	2.651	.0308	2.038	.775	8119	28.08	[illegible]	[illegible]	18
[illegible]	29.73	7939	.581	1.777	.708	.0111	2.987	.0317	2.017	.782	8119	[illegible]	[illegible]	[illegible]	19
[illegible]	[illegible]	8008	.581	1.780	.708	.0112	2.887	.0304	2.012	.778	8128	[illegible]	[illegible]	.821	20
17.93	[illegible]	6345	.467	1.383	.618	.0123	3.445	.0308	1.873	.584	4368	24.45	1.348	.802	21
12.43	[illegible]	6368	.470	1.354	.604	.0115	3.138	.0388	1.888	.575	4379	25.30	1.348	.803	22
12.34	[illegible]	6306	.468	1.348	[illegible]	.0113	3.008	.0388	1.874	.584	4354	25.84	1.345	.809	23
[illegible]	[illegible]	6319	.467	[illegible]	[illegible]	.0115	2.843	.0279	—	—	—	—	[illegible]	—	24
—	—	—	—	[illegible]	0.[illegible]	—	—	0.[illegible]	—	—	—	—	—	—	25
—	—	—	—	[illegible]	[illegible]	—	—	[illegible]	—	—	—	—	—	—	26
41.88	[illegible]	11,809	.872	[illegible]	.844	.0172	2.890	.0281	2.384	.867	[illegible]	29.73	1.849	.838	27
[illegible]	[illegible]	11,459	.848	3.880	.846	.0168	3.064	.0310	2.307	.987	[illegible]	29.78	1.847	.842	28
[illegible]	[illegible]	10,465	.773	2.873	[illegible]	.0117	3.337	.0277	2.038	.938	[illegible]	[illegible]	1.822	.850	29
27.84	36.85	9176	.677	2.018	.708	.0095	3.343	.0440	1.804	.882	8288	[illegible]	1.888	.850	30
[illegible]	30.31	7943	.578	1.462	.845	.0094	2.884	[illegible]	[illegible]	.909	8141	[illegible]	1.747	.874	31
17.70	[illegible]	[illegible]	.460	1.088	[illegible]	.0076	2.806	.0494	1.079	.974	8718	27.67	1.436	.778	32
[illegible]	57.80	12,380	.914	4.315	.836	.0130	3.348	[illegible]	[illegible]	.968	[illegible]	29.76	1.931	.842	33
[illegible]	[illegible]	12,[illegible]	.906	[illegible]	.837	[illegible]	3.340	[illegible]	2.570	.858	[illegible]	[illegible]	1.935	.841	34
[illegible]	52.80	11,[illegible]	.881	4.036	.836	.0172	3.157	[illegible]	2.507	.868	8170	30.00	[illegible]	.848	35
[illegible]	46.67	10,327	.807	3.310	.817	[illegible]	3.343	.0381	[illegible]	.837	8219	[illegible]	1.898	.848	36
[illegible]	38.71	[illegible]	.707	2.310	.744	.0114	3.346	.0394	[illegible]	.747	[illegible]	29.31	1.815	.839	37
18.40	[illegible]	8003	.606	1.785	[illegible]	.0117	3.118	.0408	[illegible]	.835	[illegible]	[illegible]	[illegible]	[illegible]	38
12.80	[illegible]	6462	.471	1.313	.612	.0114	2.806	.0381	1.470	.880	5088	[illegible]	1.456	.838	39
[illegible]	[illegible]	12,815	.924	4.444	[illegible]	.0147	4.064	[illegible]	[illegible]	.952	8188	29.82	1.900	.854	40
37.46	57.84	12,343	.911	[illegible]	.836	[illegible]	3.780	[illegible]	[illegible]	.938	8150	[illegible]	1.806	.860	41
[illegible]	54.41	12,144	.887	[illegible]	[illegible]	[illegible]	3.887	.0375	[illegible]	1.045	[illegible]	30.07	1.844	.850	42
[illegible]	50.05	11,[illegible]	.838	3.432	.803	[illegible]	4.880	.0415	2.448	.938	[illegible]	30.41	[illegible]	.853	43
18.76	39.15	9663	.730	[illegible]	[illegible]	[illegible]	3.470	.0384	[illegible]	.784	8570	29.40	1.757	.831	44
15.08	[illegible]	8464	.685	[illegible]	.707	.0142	3.888	.0408	2.114	.818	[illegible]	[illegible]	1.588	.882	45
12.44	[illegible]	6700	.498	1.527	.646	.0149	3.444	.0419	2.007	.481	4378	[illegible]	1.428	.838	46
24.41	[illegible]	—	—	4.454	[illegible]	.0153	4.048	.0546	2.712	.864	8044	30.01	1.881	.844	47
24.48	[illegible]	12,343	.911	4.417	[illegible]	.0190	3.388	[illegible]	2.713	.841	8047	30.00	1.300	.858	48
[illegible]	[illegible]	11,870	.862	[illegible]	[illegible]	.0170	4.113	[illegible]	2.576	.938	[illegible]	29.73	[illegible]	.858	49
17.93	42.80	11,317	.836	3.179	.854	.0155	3.843	.0348	2.782	.888	[illegible]	30.91	1.813	.853	50
[illegible]	33.73	9876	.780	[illegible]	.780	[illegible]	[illegible]	.0441	2.444	.888	5464	29.87	1.763	.768	51
12.90	[illegible]	8464	.685	[illegible]	.780	.0180	3.865	.0364	2.403	.780	4463	29.86	1.588	.818	52
—	—	—	—	[illegible]	[illegible]	—	—	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	53
[illegible]	[illegible]	12,384	0.913	[illegible]	0.887	0.01[illegible]	4.341	0.[illegible]	[illegible]	0.[illegible]	[illegible]	[illegible]	1.918	0.881	54
27.65	[illegible]	11,[illegible]	.881	4.088	.835	.0181	4.164	.0361	2.538	.945	8134	29.38	1.910	.848	55
21.80	[illegible]	11,[illegible]	.883	—	—	.0179	—	—	[illegible]	.980	8140	—	—	—	56
18.31	45.89	10,937	.837	3.114	.796	.0142	[illegible]	.0451	2.347	.876	8138	[illegible]	1.880	.870	57
[illegible]	38.75	[illegible]	.707	2.346	.735	.0131	4.500	[illegible]	[illegible]	.878	8134	29.41	1.847	[illegible]	58
12.45	[illegible]	[illegible]	.606	1.804	.880	.0127	4.453	[illegible]	1.513	[illegible]	8058	[illegible]	1.784	[illegible]	59
14.96	48.70	11,306	.835	[illegible]	.737	.0160	2.871	[illegible]	2.510	[illegible]	5880	31.14	1.817	[illegible]	60
14.92	46.34	11,327	.838	1.810	.740	.0155	[illegible]	[illegible]	2.544	[illegible]	5847	31.64	1.894	.848	61
[illegible]	45.01	10,707	.791	[illegible]	.778	.0154	3.313	[illegible]	2.387	.788	[illegible]	[illegible]	[illegible]	[illegible]	62
12.17	40.10	9875	.789	[illegible]	.749	.0154	2.713	.0331	2.878	.801	5814	[illegible]	[illegible]	.816	63
9.06	[illegible]	8464	.685	[illegible]	.683	.0161	[illegible]	.0412	[illegible]	[illegible]	5817	[illegible]	1.708	.846	64
7.86	[illegible]	[illegible]	.495	[illegible]	.431	.0180	[illegible]	[illegible]	1.807	.864	[illegible]	[illegible]	1.448	[illegible]	65
10.45	43.49	10,787	.796	3.081	.794	.0161	3.804	[illegible]	[illegible]	.791	[illegible]	30.17	[illegible]	.834	66
10.44	43.46	10,807	.796	3.080	.785	[illegible]	3.151	.0780	[illegible]	.787	5747	30.73	1.788	.877	67
9.34	35.74	9808	.781	[illegible]	.728	.0188	[illegible]	.0680	2.343	[illegible]	5561	[illegible]	[illegible]	[illegible]	68
7.80	32.71	8464	.685	[illegible]	.867	[illegible]	[illegible]	.0634	2.381	.430	5076	31.45	[illegible]	.834	69
6.06	[illegible]	6700	.496	1.448	.838	[illegible]	1.881	.0171	2.138	.378	[illegible]	[illegible]	1.376	.841	70

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TABLE I - COMPONENT PERFORMANCE DATA FOR

(b) Exhaust-nozzle area,

Run	Altitude (ft)	Ram pressure ratio P_2/p_0	Flight Mach number M_0	Tunnel static pressure p_0 (lb/sq ft abs)	Reynolds number index $\delta_2/\varphi_2\sqrt{\theta_2}$	Engine speed N (rpm)	Fuel flow W_f (lb/hr)	Compressor inlet total pressure P_2 (lb/sq ft abs)	Compressor inlet total temperature T_2 (°R)	Compressor outlet total pressure P_3 (lb/sq ft abs)	Compressor outlet total temperature T_3 (°R)	Turbine inlet total pressure P_4 (lb/sq ft abs)	Turbine inlet total temperature T_4 (°R)	Turbine outlet total pressure P_5 (lb/sq ft abs)	Exhaust gas total temperature T_7 (°R)
1	5000	1.016	0.150	1764	0.9921	12,813	3406	1853	471	9064	776	7829	1919	3570	1668
2		1.016	.150	1764	1.002	12,813	3386	1853	467	8078	766	7836	1705	3387	1648
3		1.0[illegible]	[illegible]	1766	1.001	11,825	2810	1856	488	7441	739	7218	1736	3611	1504
4		1.050	.275	1764	.9940	10,837	2100	1851	470	6147	707	5881	1466	3104	1304
5		1.058	.276	1764	.9930	9880	1500	1852	471	4986	641	4443	1430	2035	1283
6		1.053	.273	1765	.9890	7903	1177	1846	469	3607	602	3486	1327	2032	1202
7		1.05[illegible]	.275	1765	.9890	6856	821	1846	471	4790	[illegible]	2773	[illegible]	2014	1160
8	10,000	1.2[illegible]	.515	1454	.8416	12,813	[illegible]	1749	510	7948	818	7034	1880	3474	1867
9		1.205	.514	1457	.8482	12,813	3870	1764	509	7481	818	7036	1834	3477	1870
10		1.204	.512	1455	.8487	12,813	3925	1738	507	7723	814	6885	1770	3448	1857
11		1.207	.516	1461	.8547	12,813	3930	1755	508	7787	814	7085	1878	3480	1861
12		1.206	.516	1457	.8416	11,825	3060	1780	512	6408	782	6195	1786	3096	1491
13		1.206	.516	1459	[illegible]	11,825	2355	1780	507	6467	781	6270	1784	3132	1491
14		1.212	.524	1454	.8478	10,837	1712	1764	506	5508	736	5126	1621	2642	1348
15		1.219	.527	1450	.8038	10,837	1710	1751	507	5706	738	6108	1536	2661	1337
16		1.218	.527	1449	.8488	9880	1165	1758	510	3938	685	3791	1548	2135	1183
17		1.205	.515	1458	.8496	9880	1150	1748	507	3946	682	3765	1549	2131	1185
18		1.207	.522	1464	.8360	7903	861	1755	517	3036	643	2838	1706	1823	1110
19		1.206	.520	1454	.8406	7903	980	1765	504	3069	673	2924	1708	1871	1081
20		1.205	.518	1466	.8535	6856	754	1748	507	2941	646	2774	1084	1677	930
21		1.20[illegible]	[illegible]	1456	[illegible]	6856	760	1750	504	[illegible]	541	[illegible]	1051	1587	[illegible]
22	25,000	2.0[illegible]	1.0[illegible]	784	0.7310	12,813	3430	1577	538	[illegible]	857	6100	1876	2542	1858
23		2.060	1.061	785	.7299	12,813	2485	1577	537	6784	857	5093	1896	2548	1610
24		2.050	1.059	787	.7321	11,825	1839	1584	538	5483	798	4934	1417	2578	1419
25		2.081	1.063	785	.7364	10,837	1390	1581	535	4320	748	4154	1307	2042	1189
26		2.004	1.043	782	.7448	9880	977	1577	530	3157	682	2990	1082	1666	906
27		2.071	1.061	781	.7478	7903	837	1583	535	2766	635	2153	822	1506	718
28		1.406	.781	786	.8083	12,813	3017	1176	484	4943	786	4670	1809	2348	1611
29		1.401	.777	784	.8108	12,813	3082	1178	481	4890	784	4628	1878	2348	1616
30		1.505	.779	787	.8156	11,825	1802	1174	481	4542	742	4384	1882	2146	1467
31		1.504	.780	786	.8135	10,837	1305	1174	480	3707	704	3679	1641	1776	1241
32		1.508	.785	787	.8160	9880	879	1181	481	2516	648	2647	1150	1340	1001
33		1.500	.780	786	.8197	7903	700	1174	482	1984	596	1801	822	1108	824
34		1.499	.779	787	.8187	6856	541	1178	485	1430	547	1374	778	954	718
35		1.219	.525	788	.6400	12,813	1815	881	482	4767	789	4094	1818	2011	1858
36		1.210	.520	776	.6390	12,813	1768	836	455	4141	758	4004	1904	1170	1646
37		1.220	.535	781	.6380	11,825	1498	947	454	3681	774	3742	1710	1684	1474
38		1.211	.524	786	.6406	10,837	1180	947	449	3302	682	3161	1810	1606	1357
39		1.208	.518	781	.6328	9880	680	937	452	2874	629	2680	1280	1344	1136
40		1.211	.522	781	.6382	7903	735	942	451	1874	583	1752	1141	1057	1080
41		1.206	.521	785	.6388	6856	587	942	453	1536	534	1409	1016	932	941
42		1.082	.358	789	.4728	12,813	1570	835	452	3778	784	3637	1878	1816	1722
43		1.065	.302	784	.4721	12,813	1361	836	455	3761	784	3746	1880	1809	1708
44		1.066	.298	782	.4693	11,825	1373	838	454	3447	787	3539	1787	1089	1621
45		1.067	.296	781	.4693	11,830	1373	831	454	3460	727	3348	1767	1660	1519
46		1.066	.292	784	.4736	10,837	1118	835	451	2950	680	2644	1580	1449	1376
47		1.067	.278	786	.4657	9880	842	838	455	2141	637	2081	1435	1185	1278
48		1.058	.285	782	.4632	7903	717	830	404	1668	585	1817	1330	1015	1218
49		1.0[illegible]	.278	778	.4642	6856	[illegible]	830	457	1816	550	1310	—	836	1209
50	40,000	2.0[illegible]	1.0[illegible]	381	0.4194	12,813	1430	783	477	[illegible]	784	[illegible]	1902	[illegible]	1649
51		2.063	1.056	381	.4184	12,813	1457	781	478	3421	783	3314	1900	1606	1640
52		2.010	1.044	384	.4139	11,825	1174	788	477	—	—	—	—	1475	1469
53		2.061	1.061	385	.4197	10,837	887	788	478	2017	708	2435	1430	1169	1330
54		2.081	1.056	382	.4171	9880	678	781	476	1740	641	1678	1078	834	938
55		2.080	1.080	384	.4170	7903	538	781	477	1281	571	1191	838	648	728
56		2.038	1.068	380	.4108	6856	421	781	484	823	541	781	545	504	553
57		1.548	.782	384	.3542	12,813	1307	688	456	2656	787	2602	1980	1288	1656
58		1.580	.780	386	.3576	12,478	1188	690	454	2680	786	2500	1985	1288	1681
59		1.5[illegible]	.786	383	.3581	11,825	1008	684	452	2471	769	2335	1780	1178	1508
60		1.549	.784	384	.3580	10,837	800	687	452	2061	688	1988	1484	987	1283
61		1.513	.787	384	.3570	9880	632	686	453	1415	684	1380	1185	712	1021
62		1.5[illegible]	.784	384	.3557	7903	538	687	456	—	—	—	—	588	888
63		1.515	.781	380	.3386	6856	447	582	453	—	—	—	—	486	786
64		1.215	.524	381	.2771	12,478	1017	471	458	2162	767	2109	2013	1048	1780
65		1.228	.538	381	.2718	12,250	982	461	453	—	—	—	—	1088	1834
66		1.220	.532	386	.2726	12,113	966	460	451	2140	785	2074	1938	1093	1678
67		—	—	384	—	12,300	967	—	—	2138	755	2071	—	1030	—
68		1.224	.524	385	.2808	11,825	877	474	452	2007	734	1945	1880	989	1677
69		—	—	384	—	10,837	827	—	—	1684	694	1572	—	801	—
70		1.214	.508	382	.2675	9880	567	475	454	1161	632	1146	1380	626	1190
71		1.199	.514	380	.2673	7903	518	474	454	898	590	875	1880	534	1107
72		1.21[illegible]	[illegible]	[illegible]	.2474	6856	478	474	[illegible]	672	—	[illegible]	—	470	[illegible]
73	47,000	1.2[illegible]	0.5[illegible]	277	0.1913	12,0[illegible]	748	[illegible]	452	[illegible]	782	1472	1871	739	1710
74		1.218	.5[illegible]	287	.1878	11,830	747	347	450	1546	754	1505	1945	744	1658
75		1.208	.518	283	.1830	11,830	700	342	453	1478	741	1430	1870	705	1627
76		1.230	.535	282	.1835	11,613	700	340	451	1476	751	1430	1874	709	1625
77		1.248	.562	278	.1882	11,378	656	342	453	1392	768	1358	1780	688	1544
78		1.2[illegible]	.547	[illegible]	.1890	11,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	471	1567
79	55,000	1.831	0.7[illegible]	194	0.1727	12,100	[illegible]	[illegible]	[illegible]	1378	784	[illegible]	[illegible]	661	1763
80		1.881	.787	194	.1082	12,000	680	292	459	1321	783	1278	1908	636	1787
81		1.854	.788	194	.1086	11,728	636	285	455	1280	764	1243	1894	606	1678
82		1.868	.806	192	.1060	11,543	625	286	454	1260	748	1203	1877	601	1633

[redacted]

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XJ34-WE-32 TURBOJET ENGINE - Continued

1.138 square feet.

Engine inlet air flow $W_{a,1}$ (lb/sec)	Corrected engine inlet air flow $W_{a,1}\sqrt{\theta_2}/\delta_2$ (lb/sec)	Corrected engine speed $N/\sqrt{\theta_2}$ (rpm)	Compressor Mach number M_c	Compressor total-pressure ratio P_3/P_2	Adiabatic compressor efficiency η_c	Fuel-air ratio $\frac{W_f}{3600 W_{a,2}}$	Combustor total-pressure loss coefficient $(P_3-P_4)/q_b$	Combustor total-pressure loss ratio $(P_3-P_4)/P_3$	Combustor total-temperature ratio T_4/T_3	Combustor efficiency η_b	Corrected turbine speed $N/\sqrt{\theta_4}$ (rpm)	Corrected turbine gas flow $\frac{W_{g,4}\sqrt{\theta_4}}{\delta_4(\gamma_4/1.4)}$ (lb/sec)	Turbine total-pressure ratio P_4/P_5	Adiabatic turbine efficiency η_t	Run
54.38	88.11	13,139	0.970	4.382	0.810	0.0174	3.313	0.0300	2.478	0.945	6706	29.87	2.061	0.839	1
54.28	88.11	13,138	.970	4.380	.812	.0172	3.366	.0306	2.480	.948	6731	29.80	2.036	.862	2
50.68	87.82	12,134	.926	4.028	.844	.0148	3.156	.0306	2.352	.984	6471	29.48	1.997	.880	3
46.34	83.42	11,074	.818	3.343	.838	.0126	3.215	.0285	2.219	.946	6296	29.42	1.947	.852	4
35.17	72.86	9681	.718	2.484	.770	.0115	3.306	.0339	2.141	.930	5681	28.96	1.752	.819	5
27.88	59.87	8314	.614	1.964	.744	.0120	3.417	.0311	2.136	.811	5043	27.14	1.568	.821	6
18.66	41.16	6568	.465	1.511	.738	.0131	3.338	.0347	2.234	.688	4127	24.18	1.385	.776	7
44.70	88.61	13,838	.938	4.186	.838	.0168	3.172	.0306	2.308	.950	6686	29.88	2.058	.857	8
46.83	88.88	12,636	.938	4.161	.830	.0170	3.348	.0313	2.384	.946	6688	29.86	2.039	.864	9
46.45	88.38	12,683	.938	4.158	.831	.0168	3.380	.0316	2.384	.950	6706	29.83	2.032	.868	10
46.18	88.08	12,676	.938	4.163	.838	.0165	3.338	.0318	2.382	.947	6686	29.76	2.030	.878	11
45.82	82.04	11,606	.857	3.663	.843	.0141	3.065	.0308	2.306	.948	6470	29.77	2.001	.869	12
46.08	82.03	11,683	.861	3.707	.841	.0148	3.306	.0306	2.380	.948	6476	29.56	2.002	.870	13
40.01	47.65	10,674	.786	3.068	.830	.0119	3.077	.0343	2.367	.930	6385	29.27	1.940	.858	14
36.46	47.62	10,681	.787	3.030	.816	.0118	3.038	.0336	2.080	.934	6366	29.41	1.935	.861	15
29.92	38.84	9308	.687	2.348	.780	.0111	3.221	.0386	1.878	.815	5613	27.76	1.770	.859	16
30.32	36.35	8581	.686	2.367	.745	.0106	3.361	.0365	1.882	.836	5121	28.47	1.787	.847	17
24.12	37.06	7819	.586	1.738	.639	.0110	3.118	.0306	1.806	.718	5387	27.40	1.570	.867	18
24.36	33.06	8082	.586	1.748	.686	.0109	3.156	.0334	1.917	.710	5585	27.30	1.579	.836	19
18.57	28.88	6531	.469	1.339	.585	.0113	3.326	.0368	1.514	.686	4421	26.32	1.355	.846	20
18.71	28.87	6537	.468	1.348	.587	.0111	3.172	.0306	1.688	.674	4487	26.34	1.351	.813	21
43.11	88.33	13,407	.919	3.987	.831	.0157	3.041	.0311	2.325	.963	6776	29.78	2.074	.880	22
46.36	88.03	13,418	.917	3.961	.836	.0159	3.046	.0319	2.308	.880	6764	29.78	2.046	.867	23
35.36	81.83	11,487	.844	3.465	.835	.0156	3.096	.0345	2.078	.947	6618	29.63	2.055	.864	24
34.88	46.84	10,477	.774	2.738	.783	.0088	3.151	.0408	1.822	.962	6615	29.41	2.033	.856	25
26.18	37.81	9811	.660	1.888	.696	.0087	3.221	.0438	1.557	.583	6581	29.06	1.861	.877	26
22.70	30.36	7673	.561	1.438	.508	.0078	2.957	.0438	1.388	.884	6317	29.48	1.782	.880	27
37.84	88.86	12,961	.964	4.212	.818	.0165	2.877	.0361	2.370	.838	6783	29.14	2.068	.858	28
33.81	88.90	13,001	.960	4.254	.814	.0168	3.308	.0326	2.364	.843	6769	29.57	2.084	.861	29
30.16	87.02	11,974	.884	3.669	.838	.0140	3.148	.0326	2.258	.836	6671	29.84	2.044	.862	30
30.47	80.05	10,966	.809	3.154	.820	.0118	3.040	.0345	2.036	.873	6456	29.36	2.018	.857	31
22.73	39.81	9980	.707	2.240	.743	.0107	2.881	.0474	1.706	.836	6259	28.81	1.801	.868	32
18.16	31.58	8606	.606	1.580	.687	.0107	2.576	.0486	1.618	.455	5841	28.15	1.718	.861	33
15.86	28.03	6487	.479	1.218	.438	.0117	3.027	.0378	1.488	.861	5141	25.44	1.437	.831	34
38.81	88.13	13,484	.961	4.476	.738	.0177	4.138	.0374	2.287	.940	6713	29.78	2.036	.858	35
37.88	88.42	13,401	.949	4.450	.788	.0176	3.630	.0330	2.316	.837	6731	29.57	2.035	.859	36
37.84	87.85	12,380	.911	4.088	.838	.0180	3.736	.0381	2.388	.830	6682	29.45	2.030	.864	37
35.01	81.97	11,387	.838	3.456	.827	.0131	3.806	.0364	2.114	.875	6317	29.40	1.977	.857	38
19.05	60.10	8575	.788	2.634	.778	.0127	3.363	.0354	2.061	.706	6082	28.87	1.837	.807	39
18.08	51.86	8480	.626	1.984	.708	.0138	3.661	.0347	1.957	.888	5406	27.78	1.658	.842	40
16.88	38.04	6706	.436	1.411	.578	.0148	2.736	.0371	1.608	.455	4585	26.80	1.403	.848	41
36.13	89.43	13,401	.959	4.388	.782	.0145	3.807	.0305	2.382	.946	6486	29.41	2.014	.851	42
36.21	88.67	13,401	.959	4.806	.785	.0165	3.378	.0306	2.388	.946	6645	29.46	2.015	.845	43
34.31	87.81	12,380	.909	4.143	.834	.0157	3.578	.0313	2.417	.938	6448	29.40	2.000	.840	44
34.36	88.06	12,380	.909	4.104	.838	.0156	3.387	.0324	2.417	.836	6449	29.41	2.006	.853	45
31.84	81.87	11,306	.835	3.547	.830	.0142	3.861	.0318	2.097	.875	6157	29.38	1.881	.836	46
18.85	38.74	9675	.757	2.563	.768	.0144	2.596	.0300	2.383	.763	5883	28.48	1.754	.802	47
10.54	28.43	8448	.634	2.034	.738	.0136	4.582	.0306	2.386	.848	5016	25.04	1.585	.730	48
9.17	88.80	6600	.468	1.827	.611	.0178	4.481	.0490	—	—	—	—	—	—	49
33.84	89.18	13,881	.965	4.388	.806	.0173	3.318	.0313	2.438	.950	6738	29.38	2.068	.741	50
33.39	88.90	13,064	.964	4.388	.806	.0174	3.348	.0313	2.457	.981	6742	29.45	2.065	.844	51
29.07	87.05	12,081	.887	—	—	.0148	—	—	—	.911	—	—	—	—	52
19.64	48.71	10,988	.810	3.188	.863	.0188	3.536	.0334	2.088	.786	6480	29.15	2.048	.838	53
15.81	40.81	9636	.711	2.211	.738	.0118	3.544	.0400	1.678	.481	6484	29.41	2.013	.830	54
12.80	31.56	8343	.608	1.888	.667	.0128	3.160	.0480	1.408	.389	6357	29.18	1.844	.847	55
9.84	24.65	6475	.478	1.040	.088	.0128	2.647	.0510	1.081	.047	6807	27.88	1.880	.764	56
17.58	88.38	13,351	.966	4.507	.769	.0151	3.618	.0315	2.542	.886	6883	29.08	2.080	.848	57
17.78	89.12	13,336	.964	4.467	.777	.0154	3.298	.0308	2.380	.935	6836	29.73	2.080	.871	58
17.80	88.88	12,343	.911	4.147	.819	.0158	3.384	.0306	2.488	.883	6856	29.80	2.033	.872	59
15.48	80.39	11,885	.833	3.436	.811	.0144	3.018	.0302	2.177	.781	6844	29.90	2.015	.834	60
11.88	38.63	9675	.738	2.371	.749	.0147	3.218	.0364	1.891	.826	6806	29.34	1.806	.868	61
9.66	38.12	8440	.632	—	—	.0156	—	—	—	.384	—	—	—	—	62
7.88	28.48	6700	.436	—	—	.0164	—	—	—	.818	—	—	—	—	63
13.96	88.62	13,984	.978	4.580	.784	.0202	3.384	.0276	2.636	.836	6483	29.28	2.047	.843	64
14.27	88.65	13,130	.965	—	—	.0181	—	—	—	.830	—	—	—	—	65
14.28	58.89	12,997	.969	4.458	.781	.0186	3.465	.0304	2.856	.765	6481	28.80	2.068	.838	66
—	—	—	—	—	—	—	—	.0304	—	—	—	—	2.030	—	67
13.76	87.38	12,343	.911	4.384	.819	.0177	3.480	.0318	2.480	.675	6138	29.40	2.026	.880	68
—	—	—	—	—	.787	—	—	.0330	—	—	—	—	1.365	—	69
9.07	37.78	9656	.788	2.448	.730	.0180	2.801	.0330	2.130	.882	5810	28.15	1.340	.818	70
7.12	38.72	8446	.684	1.887	.671	.0202	2.786	.0347	2.066	.438	5827	27.81	1.328	.885	71
5.38	28.81	6686	.484	1.480	.580	.0202	—	.0366	—	.310	—	—	—	—	72
10.04	88.88	13,111	.962	4.388	.784	.0184	3.388	.0308	2.397	.687	6888	29.81	2.310	.838	73
10.19	87.88	12,881	.948	4.488	.788	.0188	3.064	.0285	2.377	.946	6370	29.80	2.065	.845	74
9.78	84.74	12,488	.882	4.304	.815	.0191	3.160	.0272	2.384	.882	6311	29.80	2.040	.838	75
9.81	85.70	12,438	.818	4.347	.812	.0198	3.048	.0264	2.388	.830	6318	29.73	2.041	.838	76
9.82	85.08	12,076	.861	4.070	.814	.0188	3.306	.0257	2.448	.788	6857	29.84	2.081	.838	77
9.60	88.31	11,108	.844	4.118	.808	.0204	3.188	.0286	2.471	.734	6890	29.08	2.017	.833	78
6.88	88.38	13,380	.978	4.604	.775	.0215	3.387	.0288	2.862	.843	6371	29.38	2.061	.838	79
6.60	88.12	12,982	.949	4.480	.780	.0212	3.178	.0278	2.828	.837	6389	29.45	2.040	.838	80
6.33	88.94	12,882	.934	4.330	.794	.0212	3.418	.0288	2.592	.789	6387	29.73	2.041	.838	81
6.35	86.88	12,381	.913	4.271	.800	.0206	3.381	.0284	2.816	.785	6371	29.85	2.036	.846	82

TABLE I - COMPONENT PERFORMANCE DATA FOR

(a) Exhaust-nozzle area,

Run	Altitude (ft)	Ram pressure ratio P_2/p_0	Flight Mach number M_0	Tunnel static pressure p_0 (lb/sq ft abs)	Reynolds number index $\delta_2/\varphi_2\sqrt{\theta_2}$	Engine speed N (rpm)	Fuel flow W_f (lb/hr)	Compressor inlet total pressure P_2 (lb/sq ft abs)	Compressor inlet total temperature T_2 (°R)	Compressor outlet total pressure P_3 (lb/sq ft abs)	Compressor outlet total temperature T_3 (°R)	Turbine inlet total pressure P_4 (lb/sq ft abs)	Turbine inlet total temperature T_4 (°R)	Turbine outlet total pressure P_5 (lb/sq ft abs)	Exhaust gas total temperature T_7 (°R)
1	5000	1.061	0.278	1759	1.001	12,513	2618	1856	462	7438	768	[illegible]	1863	3336	1411
2		1.064	.282	1752	1.001	12,513	[illegible]	1866	457	7601	754	7260	1866	3343	1616
3		1.060	.283	1761	1.006	11,535	2155	1862	457	6548	735	6702	1513	3119	1291
4		1.062	.267	1756	1.006	10,557	1730	1860	467	5800	680	6073	1382	2781	1182
5		1.057	.278	1760	1.000	9220	1351	1857	470	4474	644	4304	1298	2563	1139
6		1.027	.280	1758	1.000	7808	1055	1865	470	3450	588	3677	1228	2128	1113
7		1.016	.280	1765	.9970	6858	865	1861	472	2705	555	2636	1180	1955	1111
8	10,000	1.207	.518	1462	.8502	12,513	2876	1742	508	6741	[illegible]	8615	1880	[illegible]	[illegible]
9		1.209	.519	1458	.8432	12,513	2860	1744	516	6707	802	8676	1862	2864	1406
10		1.206	0.516	1452	0.8378	12,513	2845	1741	518	6587	805	8453	1878	2851	1437
11		1.211	.502	1456	.8432	11,535	1827	1760	511	6022	773	5800	1510	2581	1282
12		1.209	.505	1453	.8438	11,535	1882	1747	510	6026	778	5804	1518	2573	1269
13		1.208	.520	1464	.8518	10,557	1308	1747	508	4954	730	4792	1343	2356	1149
14		1.207	.520	1454	.8476	10,557	1307	1748	520	4876	728	4774	1356	2304	1150
15		1.208	.504	1458	.8488	9220	1088	1748	520	3781	680	3641	1263	1978	1078
16		1.207	.502	1459	.8438	9220	1080	1748	512	3738	680	3546	1251	1980	1076
17		1.208	.501	1452	.8468	7808	817	1747	508	2856	635	2867	1134	1777	1013
18		1.208	.503	1464	.8453	7808	815	1758	511	2786	636	2828	1121	1772	1013
19		1.205	.501	1468	.8432	6858	780	1781	513	2306	587	2632	1027	1435	980
20		1.208	.504	1460	.8438	6858	718	1762	511	2302	587	2616	1016	1430	945
21	25,000	2.[illegible]	1.061	784	0.7[illegible]	12,513	[illegible]	1876	[illegible]	6492	814	6871	1814	[illegible]	[illegible]
22		2.046	1.057	777	.7746	12,513	1985	1872	503	6677	782	5738	1502	2545	1571
23		2.060	1.058	764	.7342	12,513	1857	1877	535	6577	818	5651	1529	2594	1378
24		2.035	1.063	762	.7664	11,535	1419	1874	535	5158	773	4922	1421	2326	1175
25		2.046	1.058	761	.7184	10,557	1060	1565	550	4371	735	3883	1150	1775	954
26		2.036	1.057	765	.7357	9220	783	1565	538	2948	681	2757	880	1238	769
27		2.032	1.065	762	.7356	7808	570	1578	554	2146	635	2027	735	1094	638
28		1.515	.758	764	.6058	12,513	1557	1178	454	4615	774	4458	1630	2081	1580
29		1.521	.760	761	.6108	12,513	1572	1178	462	4525	770	4457	1634	2007	1580
30		1.505	.754	761	.6127	11,535	1300	1165	455	4535	741	4044	1460	1460	1255
31		1.518	.761	761	.6124	10,557	1040	1178	454	3496	701	3550	1354	1435	1080
32		1.513	.760	761	.6124	9220	818	1177	459	[illegible]	648	3452	1080	1313	905
33		1.512	.757	762	.6143	7808	664	1177	452	1807	665	1806	880	1035	768
34		1.506	.800	768	.6219	6858	580	1187	453	—	—	—	—	815	665
35		1.221	.535	778	.5311	12,513	1570	945	454	3656	756	3722	1680	1091	1407
36		1.219	.535	781	.5306	12,513	1573	947	455	3580	741	3725	1680	1085	1396
37		1.224	.539	762	.5348	11,535	1180	947	454	3215	719	3406	1487	1054	1271
38		1.216	.531	766	.5362	10,557	1001	944	455	3066	675	2967	1356	1059	1159
39		1.217	.534	750	.5306	9220	807	947	457	—	656	—	1164	1135	1004
40		1.216	.534	762	.5316	7808	662	945	457	—	654	—	1068	981	980
41		1.208	.536	764	.5270	6858	554	942	457	1882	580	1842	906	887	804
42		1.064	.278	768	.4665	12,513	1880	630	458	3638	748	3516	1710	1509	1424
43		1.064	.277	764	.4666	12,513	1987	[illegible]	457	3449	745	3380	1709	1509	1453
44		1.066	.282	762	.4685	11,535	1107	630	454	3196	715	3061	1548	1448	1316
45		1.060	.288	768	.4706	10,571	930	[illegible]	454	2738	683	2696	1411	1217	1308
46		1.058	.285	762	.4636	9220	778	627	456	2081	634	1971	1301	1075	1148
47		1.054	.276	762	.4621	7808	676	[illegible]	456	1800	588	1550	1248	943	1182
48		1.055	.276	775	.4670	6858	554	[illegible]	[illegible]	1614	546	1180	1185	873	1160
49	40,000	2.0[illegible]	1.060	394	0.4[illegible]	12,513	1080	791	[illegible]	3167	776	[illegible]	1641	1343	[illegible]
50		2.068	1.061	398	.4127	12,513	1084	791	461	3116	772	3006	1641	1344	1396
51		2.008	1.047	394	.4112	11,535	940	796	461	2636	769	2736	1673	1289	1346
52		2.061	1.051	394	.4108	10,557	768	792	463	2307	761	2217	1548	1004	1047
53		2.036	1.057	393	.4146	9220	592	794	462	1630	646	1656	978	735	818
54		2.083	1.047	389	.4087	7808	478	776	461	1152	[illegible]	1134	788	675	691
55		2.015	1.071	391	.4162	6858	338	606	465	784	[illegible]	743	—	465	—
56		1.531	.787	397	.3896	12,513	948	605	455	2485	764	2579	1880	1076	1401
57		1.534	.788	397	.3456	12,513	954	604	448	2571	740	2413	1666	1074	1409
58		1.524	.792	401	.3486	11,535	880	608	448	2318	708	2043	1478	1007	1348
59		1.528	.793	401	.3496	10,557	780	607	455	1538	674	1872	1280	844	1043
60		1.523	.786	396	.3380	9220	611	601	456	1357	618	1589	1038	688	938
61		1.515	.790	396	.3369	7808	522	600	456	1080	576	882	912	544	831
62		1.506	.787	398	.3354	6858	480	588	456	721	521	667	738	474	671
63		1.226	.535	396	.2726	12,513	889	621	450	2917	636	1987	1780	679	1480
64		1.214	.535	401	.2760	12,513	830	465	452	2035	748	1978	1783	669	1454
65		1.207	.520	401	.2771	11,535	740	462	452	1667	727	1790	1580	688	1319
66		1.204	.518	402	.2734	10,557	664	459	453	1408	661	1544	1376	720	1170
67		1.208	.511	401	.2717	9220	565	474	452	1177	636	1116	1218	680	1067
68		1.196	.518	397	.2694	7808	468	473	452	890	580	858	1111	507	897
69		1.201	.519	394	.2460	6858	446	472	455	658	[illegible]	636	1018	464	847
70	47,000	1.[illegible]	.544	[illegible]	.1951	12,513	[illegible]	[illegible]	[illegible]	1687	[illegible]	1661	1776	[illegible]	1513
71		1.206	.540	287	.1766	12,513	672	345	450	1478	754	1450	1761	644	1616
72		1.203	.536	287	.1967	11,535	622	340	450	1380	728	1336	1580	607	1354
73		1.200	.535	282	.1939	10,557	570	342	452	1151	684	1113	1411	580	1306
74		1.206	.504	282	.1928	9220	484	340	456	858	625	750	1250	414	1075
75		1.204	.502	280	.1906	7808	453	337	456	673	587	617	1169	364	1040
76		1.207	.506	280	.1891	6858	407	[illegible]	[illegible]	447	—	446	—	[illegible]	846
77	55,000	1.510	0.781	194	0.1[illegible]	12,513	601	[illegible]	[illegible]	1546	761	1518	1814	647	1547
78		1.538	.802	192	.1764	11,936	579	285	452	1204	738	1166	1680	618	1418
79		1.521	.802	188	.1644	11,565	560	280	452	1140	737	1102	1808	601	1368
80		1.531	.772	192	.1606	10,513	517	262	452	1004	686	975	1438	448	1296
81		1.487	.788	193	.1604	10,313	466	288	451	875	674	845	1300	381	1146
82		1.531	.781	194	.1621	9108	432	285	450	802	635	850	1136	334	978
83		1.171	.808	196	.1337	12,618	838	227	454	1040	773	1009	1656	484	1630
84		1.201	.836	190	.1307	12,436	530	221	459	1085	761	983	1900	453	1650
85		1.201	.819	194	.1306	12,286	527	222	451	1008	757	960	1648	448	1584
86		1.215	.868	191	.1307	12,063	507	221	456	876	751	851	1806	435	1508
87		1.206	.818	194	.1317	11,863	443	225	453	938	758	911	1709	430	1463
88		1.280	.843	188	.1366	11,080	443	221	448	916	718	680	1640	409	1408
89		1.300	.819	190	.1402	10,938	476	246	449	854	714	681	1636	388	1406

NACA

XJ34-WE-32 TURBOJET ENGINE - Continued

1.334 square feet.

Engine inlet air flow $W_{a,2}$ (lb/sec)	Corrected engine inlet air flow $W_{a,2}\sqrt{\theta_2}/\delta_2$ (lb/sec)	Corrected engine speed $N/\sqrt{\theta_2}$ (rpm)	Compressor Mach number M_c	Compressor total-pressure ratio P_3/P_2	Adiabatic compressor efficiency η_c	Fuel-air ratio $\frac{W_f}{3600\,W_{a,2}}$	Combustor total-pressure loss coefficient $(P_3-P_4)/q_m$	Combustor total-pressure loss ratio $(P_3-P_4)/P_3$	Combustor total temperature ratio T_4/T_3	Combustor efficiency η_b	Corrected turbine speed $N/\sqrt{\theta_4}$ (rpm)	Corrected turbine gas flow $\frac{W_{g,4}\sqrt{\theta_4}}{\delta_4(\gamma_4/1.4)}$ (lb/sec)	Turbine total-pressure ratio P_4/P_5	Adiabatic turbine efficiency η_t	Run
54.57	59.42	13,176	0.973	4.085	0.734	0.0152	3.140	0.0237	2.205	0.964	7171	29.90	2.188	0.856	1
54.60	59.36	13,164	.972	4.035	.810	.0153	3.138	.0288	2.208	.964	7156	29.94	2.168	.845	2
53.62	57.41	12,147	.887	3.725	.827	.0114	3.012	.0346	2.095	.963	6888	29.96	2.138	.847	3
47.57	51.38	11,106	.820	3.172	.818	.0101	3.218	.0388	2.005	.887	6583	29.90	2.040	.849	4
38.13	39.16	9790	.715	2.425	.772	.0102	3.400	.0380	2.016	.866	5935	28.56	1.821	.838	5
30.46	30.37	8306	.615	1.885	.757	.0107	3.068	.0384	2.042	.783	5206	28.57	1.591	.852	6
[illegible]	23.04	6563	.494	1.452	.640	.0106	[illegible]	[illegible]	[illegible]	.773	4801	27.32	[illegible]	[illegible]	7
[illegible]	56.57	12,878	.936	3.670	.815	[illegible]	3.013	[illegible]	2.125	.965	7138	[illegible]	[illegible]	[illegible]	8
46.80	58.30	12,628	.932	3.846	.881	.0129	3.086	.0348	2.072	.945	7171	29.47	2.186	.853	9
48.55	59.60	12,801	0.883	3.441	0.880	0.0122	3.117	0.0380	2.024	0.887	7143	29.73	2.157	0.852	10
45.96	55.05	11,627	.865	3.441	.857	.0111	3.080	.0347	1.981	.880	6806	29.90	2.158	.874	11
44.10	55.38	11,628	.859	3.442	.837	.0118	3.049	.0367	1.988	.947	6883	29.73	2.188	.848	12
40.05	47.76	10,653	.716	2.858	.817	.0087	3.276	.0405	1.880	.875	6880	29.24	2.088	.857	13
30.94	47.96	10,638	.705	2.846	.812	.0086	3.246	.0404	1.863	.880	6838	29.49	2.084	.858	14
31.65	37.90	9505	.607	2.195	.713	.0087	3.177	.0385	1.813	.780	6076	28.98	1.844	.840	15
31.44	37.62	9285	.606	2.136	.760	.0086	2.988	.0382	1.810	.778	6082	28.82	1.470	.861	16
24.77	29.79	7982	.508	1.709	.880	.0103	3.443	.0389	1.791	.843	5417	27.98	1.413	.840	17
24.76	29.71	7968	.506	1.663	.870	.0101	3.084	.0351	1.781	.836	5434	27.71	1.414	.862	18
18.46	22.18	6624	.405	1.318	.870	.0106	3.167	.0314	1.780	.841	4487	26.15	1.340	.779	19
[illegible]	[illegible]	6506	.402	[illegible]	[illegible]	.0104	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.17	[illegible]	[illegible]	20
[illegible]	[illegible]	13,677	0.981	[illegible]	0.819	0.0131	[illegible]	[illegible]	[illegible]	0.980	7327	[illegible]	[illegible]	0.851	21
43.31	58.65	12,713	.938	3.69	.808	.0121	3.376	.0385	2.088	.943	7288	29.80	2.246	.843	22
43.24	56.57	12,642	.918	3.727	.818	.0120	3.157	.0381	1.381	.882	7237	29.60	2.249	.858	23
40.38	44.79	11,461	.848	3.357	.821	.0087	3.105	.0314	1.524	.816	7108	29.84	2.225	.841	24
38.05	46.91	10,506	.778	2.589	.781	.0084	3.086	.0437	1.481	.712	7082	29.46	2.138	.802	25
30.21	37.40	8186	.676	1.888	.806	.0074	3.087	.0512	1.388	.440	6838	29.01	2.030	.873	26
30.55	30.37	7685	.581	1.359	.482	.0070	3.004	.0380	1.177	.323	6813	28.41	1.854	.878	27
33.77	54.56	12,951	.958	3.219	.738	.0126	3.042	.0340	2.108	.342	7837	28.46	2.288	.888	28
34.01	57.06	12,968	.959	3.984	.801	.0128	3.284	.0380	2.128	.345	7288	29.74	2.281	.880	29
32.80	54.71	11,817	.880	3.371	.828	.0130	3.218	.0381	1.979	.304	7014	29.56	2.274	.832	30
30.08	50.40	10,906	.808	2.785	.815	.0089	3.128	.0408	1.732	.761	6887	28.87	2.161	.835	31
28.57	38.63	8570	.708	2.183	.735	.0089	3.254	.0426	1.641	.549	6828	28.85	2.088	.838	32
18.81	31.56	6805	.625	1.608	.816	.0101	2.904	.0438	1.459	.388	5970	28.46	1.748	.848	33
13.98	22.47	6487	.479	—	—	.0108	—	—	—	.355	—	—	—	—	34
30.06	58.62	13,376	.967	4.080	.778	.0128	3.326	.0348	2.381	.355	7173	29.68	2.201	.845	35
30.28	59.57	13,364	.967	4.065	.785	.0124	3.320	.0343	2.387	.345	7136	29.58	2.206	.838	36
27.91	58.06	12,887	.901	3.768	.821	.0117	2.961	.0343	2.088	.914	6888	29.43	2.188	.830	37
26.51	52.38	11,354	.831	3.347	.805	.0109	2.947	.0356	1.888	.818	6716	29.70	2.138	.816	38
19.88	40.81	9428	.785	—	—	.0118	—	—	1.888	.681	6867	—	—	—	39
15.34	32.06	8486	.635	—	—	.0128	—	—	1.830	.588	5877	—	—	—	40
11.39	25.86	6885	.490	1.388	.806	.0132	2.762	.0312	1.835	.439	4587	27.38	1.384	.861	41
24.86	57.30	13,304	.867	4.138	.783	.0143	3.267	.0336	1.881	.845	7077	30.09	2.170	.849	42
22.72	54.14	13,330	.845	4.143	.787	.0157	3.085	.0348	2.088	.888	7081	27.33	2.206	.838	43
24.38	58.05	13,380	.910	3.861	.825	.0126	2.887	.0380	2.181	.816	6836	28.83	2.138	.848	44
24.72	58.56	11,384	.828	3.349	.819	.0106	2.435	.0381	2.088	.832	6816	28.97	2.048	.852	45
17.90	41.00	9436	.786	2.460	.780	.0130	3.140	.0387	2.088	.720	5888	28.41	1.841	.838	46
13.39	33.18	8433	.635	1.837	.838	.0141	2.848	.0313	2.078	.687	5186	28.13	1.808	.815	47
[illegible]	[illegible]	6654	.497	1.460	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4147	27.78	[illegible]	[illegible]	48
[illegible]	[illegible]	13,000	0.988	[illegible]	0.789	0.0136	[illegible]	[illegible]	[illegible]	[illegible]	4313	[illegible]	[illegible]	[illegible]	49
22.57	59.16	13,001	.980	3.836	.794	.0132	3.189	.0366	2.138	.888	7218	29.67	2.336	.859	50
22.17	57.31	11,974	.884	3.605	.816	.0118	2.585	.0387	1.886	.848	6989	29.53	2.208	.838	51
19.40	50.01	10,887	.807	2.815	.765	.0110	2.961	.0380	1.778	.866	6819	29.45	2.024	.857	52
15.66	40.12	9870	.707	2.045	.699	.0125	2.574	.0472	1.809	.416	5794	28.85	2.119	.876	53
12.89	33.76	8811	.606	1.532	.588	.0102	2.534	.0457	1.888	.387	5642	28.95	1.878	.789	54
9.40	25.56	6468	.478	.9730	.567	.0099	2.589	.0385	—	—	—	—	1.532	—	55
17.96	58.61	13,401	.980	4.118	.771	.0144	3.302	.0336	2.385	.561	7178	29.38	2.380	.882	56
18.01	59.62	13,464	.974	4.141	.768	.0147	3.508	.0380	2.385	.888	7191	29.57	2.347	.838	57
17.72	57.55	13,389	.918	3.667	.811	.0151	2.980	.0368	2.068	.832	6881	29.88	2.307	.835	58
18.05	51.00	11,888	.833	3.154	.807	.0153	2.963	.0346	1.888	.824	6880	28.85	2.213	.818	59
12.15	40.10	9436	.726	2.268	.734	.0160	3.346	.0438	1.474	.632	6838	28.70	2.085	.817	60
9.57	32.96	8433	.623	1.713	.692	.0166	3.585	.0448	1.585	.368	5814	27.46	1.805	.838	61
7.81	25.57	6575	.463	1.304	.369	.0186	2.917	.0402	1.475	.168	4887	26.76	1.480	.838	62
14.45	59.19	13,430	.988	4.153	.768	.0159	4.138	.0336	2.387	.367	7048	29.86	2.388	.834	63
14.38	59.41	13,401	.989	4.136	.772	.0156	2.906	.0386	2.300	.873	7058	29.72	2.197	.843	64
13.96	57.38	12,343	.911	3.475	.807	.0149	3.419	.0364	2.138	.784	6888	28.82	2.179	.832	65
13.65	52.65	11,388	.833	3.366	.812	.0148	3.443	.0388	2.081	.846	6832	28.80	2.144	.809	66
9.40	38.76	9675	.723	2.457	.765	.0173	4.738	.0301	1.838	.682	6186	28.18	1.836	.837	67
7.48	30.57	8484	.605	1.474	.681	.0196	3.230	.0348	1.808	.588	5481	27.81	1.838	.788	68
[illegible]	[illegible]	6700	.436	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4840	[illegible]	[illegible]	[illegible]	69
[illegible]	[illegible]	13,401	0.988	4.310	0.770	0.0121	[illegible]	0.0386	2.345	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70
20.32	58.34	13,430	.882	4.087	.795	.0121	3.386	.0351	2.369	.811	6866	29.64	2.414	.833	71
20.18	57.04	12,378	.874	3.764	.809	.0219	3.170	.0319	2.314	.717	6762	27.19	2.380	.813	72
8.88	51.35	11,388	.833	3.365	.805	.0176	3.040	.0350	2.031	.588	6529	28.57	2.140	.814	73
6.74	39.15	9675	.728	2.488	.738	.0206	3.046	.0361	1.367	.480	6080	28.90	1.868	.709	74
5.17	30.32	8484	.605	1.880	.678	.0241	3.065	.0314	1.574	.158	6880	27.61	1.498	.731	75
[illegible]	[illegible]	[illegible]	.436	[illegible]	—	[illegible]	—	[illegible]	—	[illegible]	—	—	[illegible]	—	76
[illegible]	57.38	13,808	0.987	4.391	0.744	0.0128	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29.57	[illegible]	[illegible]	77
8.68	58.10	12,780	.944	4.109	.785	.0186	3.172	.0315	2.301	.706	6887	29.57	2.347	.808	78
8.30	58.52	12,364	.914	3.781	.780	.0184	2.881	.0383	2.305	.677	6760	29.94	2.300	.830	79
7.66	51.34	11,881	.863	3.436	.784	.0187	2.988	.0308	2.085	.541	6848	29.96	2.178	.811	80
6.36	44.00	11,088	.817	3.058	.780	.0184	2.700	.0308	1.882	.580	6560	29.08	2.163	.785	81
5.61	37.36	9886	.738	2.880	.676	.0214	2.435	.0384	1.615	.387	6615	27.98	2.004	.824	82
7.11	58.37	13,378	.987	4.380	.780	.0211	3.138	.0288	2.487	.776	6748	30.08	2.174	.836	83
6.88	59.18	13,181	.962	4.437	.803	.0213	2.447	.0312	2.388	.789	6708	29.74	2.158	.734	84
6.36	58.52	13,117	.988	4.381	.787	.0226	2.611	.0278	2.437	.748	6860	29.78	2.202	.807	85
4.63	54.07	12,819	.954	4.328	.775	.0212	2.188	.0288	2.406	.717	6881	29.90	2.187	.801	86
6.66	58.42	12,384	.914	4.085	.792	.0206	2.382	.0288	2.135	.676	6861	29.44	2.170	.828	87
6.84	59.86	12,106	.894	3.368	.791	.0206	2.330	.0284	2.311	.641	6438	29.39	2.168	.786	88
6.42	51.57	11,786	.868	3.472	.794	.0208	2.808	.0287	2.330	.637	6330	30.41	2.142	.812	89

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TABLE I - COMPONENT PERFORMANCE DATA FOR

(d) Exhaust-nozzle area,

Run	Altitude (ft)	Ram pressure ratio P_0/p_0	Flight Mach number M_0	Tunnel static pressure p_0 (lb/sq ft abs)	Reynolds number index $\delta_2/\varphi_2\sqrt{\theta_2}$	Engine speed N (rpm)	Fuel flow W_f (lb/hr)	Compressor inlet total pressure P_2 (lb/sq ft abs)	Compressor inlet total temperature T_2 (°R)	Compressor outlet total pressure P_3 (lb/sq ft abs)	Compressor outlet total temperature T_3 (°R)	Turbine inlet total pressure P_4 (lb/sq ft abs)	Turbine inlet total temperature T_4 (°R)	Turbine outlet total pressure P_5 (lb/sq ft abs)	Exhaust gas total temperature T_7 (°R)
1	5000	1.060	0.278	1756	0.9960	12,513	1774	1653	470	6682	757	6431	1340	2537	1095
2		1.065	.305	1756	1.006	12,513	1767	1678	470	6741	757	6475	1336	2599	1083
3		1.061	.290	1755	.9635	12,513	1770	1655	475	6682	743	6430	1345	2546	1100
4		1.058	.278	1756	1.007	11,886	1562	1655	467	6251	707	6012	1238	2427	1026
5		1.056	.280	1755	1.000	10,937	1386	1652	469	5430	678	5224	1177	2268	955
6		1.055	.275	1757	.9960	9280	1206	1650	470	4153	634	4024	1111	2079	954
7		1.054	.273	1758	1.012	7805	1064	1643	465	3562	569	3246	1080	1967	972
8		1.064	.278	1757	1.006	6954	916	1661	469	2799	[illegible]	2844	1096	1882	1009
9	20,000	1.806	0.587	1454	0.8584	12,513	1536	1765	509	6057	788	5734	1340	2281	1097
10		1.804	.582	1456	.8484	12,513	1514	1758	513	6022	788	5645	1327	2211	1080
11		1.811	.531	1450	.8554	11,886	1341	1786	506	5517	746	5076	1236	2076	959
12		1.808	.588	1447	.8532	10,937	1174	1759	508	4614	715	4471	1130	1908	931
13		1.805	.584	1452	.8554	9280	1008	1760	507	3542	668	3540	1069	1758	915
14		1.810	.589	1450	.8480	7805	848	1755	515	[illegible]	626	2693	1094	1630	919
15		1.808	.584	1455	.8466	6954	721	1758	510	2861	561	2160	949	1562	963
16	35,000	1.813	0.783	761	0.6101	12,513	1145	1262	485	4136	788	3877	1365	1659	1053
17		1.804	.787	765	.6086	12,513	1154	1270	484	4131	755	3807	1300	1430	1067
18		1.807	.788	763	.6137	11,886	1036	1180	484	3752	723	3585	1154	1314	930
19		1.806	.790	761	.6090	10,937	879	1178	486	3168	665	2979	1014	1184	818
20		1.806	.790	782	.6138	9280	705	1178	489	2583	636	2341	881	998	738
21		1.497	.783	784	.6044	7805	635	1175	485	1778	593	1669	788	917	682
22		1.815	.784	786	.6162	6256	509	1181	484	1381	548	1382	685	864	684
23		1.296	.624	786	.5336	12,513	1059	954	455	3449	785	3377	1300	1364	1056
24		1.310	.524	780	.5571	12,513	1036	940	484	3419	721	3271	1300	1285	1056
25		1.216	.529	758	.5384	11,886	950	951	488	2824	681	3076	1170	1156	945
26		1.215	.529	761	.5336	10,937	830	948	454	2607	643	2680	1076	1097	869
27		1.211	.528	761	.5315	9280	768	944	455	2038	617	2034	972	788	870
28		1.214	.532	752	.5330	7930	683	948	455	1849	573	1670	930	482	825
29		1.204	.522	753	.5302	6954	587	943	455	1290	531	1215	882	847	820
30		1.068	.308	785	.4773	12,513	984	837	480	3070	761	2963	1347	1160	1100
31		1.065	.290	782	.4675	12,513	874	838	484	3068	736	2638	1350	1154	1156
32		1.066	.302	786	.4748	11,886	832	837	458	2824	698	2757	1230	1115	1007
33		1.065	.303	784	.4782	10,937	670	838	461	2542	665	2443	1140	1045	941
34		1.068	.296	781	.4735	9280	777	838	442	1980	617	1846	1085	937	975
35		1.069	.270	785	.4738	7930	687	838	446	1540	575	1465	1070	779	958
36		1.068	.277	784	.4780	6954	618	838	480	1212	532	1182	1030	843	1009
37	40,000	2.084	1.066	388	0.4061	12,513	684	804	477	2836	763	2744	[illegible]	956	1073
38		1.996	1.080	388	.4095	12,513	688	787	475	2782	758	2571	1383	948	1076
39		2.064	1.064	380	.4185	11,886	635	788	476	2805	721	2451	1173	676	944
40		2.028	1.061	380	.4082	10,937	673	784	481	2118	680	2090	1016	735	814
41		2.036	1.058	381	.4105	9280	503	782	484	1506	636	1490	780	646	634
42		2.049	1.065	389	.4188	9280	508	785	477	1517	638	1436	783	667	651
43		1.580	.796	384	.3361	12,515	778	598	482	—	—	—	—	756	1074
44		1.565	.794	386	.3422	12,513	775	600	480	2232	728	2229	1319	766	1071
45		1.555	.806	384	.3414	11,886	738	606	483	2036	695	1652	1170	710	960
46		1.550	.800	384	.3403	10,937	650	600	456	—	—	—	—	654	698
47		1.578	.800	386	.3343	9280	588	597	453	—	—	—	—	685	717
48		1.557	.800	385	.3436	7805	502	602	448	—	—	—	—	480	672
49		1.240	.585	381	—	12,513	665	483	—	—	—	—	—	—	—
50		1.806	.521	389	.2845	12,513	667	465	458	1724	731	1676	1380	552	1115
51		1.718	.588	387	.2882	11,886	642	465	461	1617	696	1654	1336	536	1000
52		1.206	.521	388	.2843	10,937	602	468	454	1415	587	1448	1190	488	817
53		1.206	.504	386	.2857	9280	535	469	455	1053	651	1127	1035	492	678
54		1.208	.511	388	—	7805	510	471	—	826	578	948	—	—	—
55		1.191	.502	382	—	6954	470	478	—	698	566	729	—	—	—
56	47,000	1.213	0.531	283	0.1968	12,513	588	345	450	1320	733	1361	1376	450	1141
57		1.225	.542	280	.1985	12,500	564	342	447	1306	731	1257	1384	467	1136
58		1.255	.566	277	.1985	12,500	564	342	450	1296	734	1243	1400	456	1167
59		1.216	.538	284	.1863	12,000	534	346	446	1270	718	1228	1326	460	1087
60		1.229	.547	275	.1990	11,886	548	337	461	1186	705	1119	1298	435	1054
61		1.215	.538	283	.1974	11,513	580	341	445	1180	691	1128	1230	456	1002
62		1.209	.524	283	.1929	10,866	515	340	453	1080	674	1013	1160	409	958
63		1.213	.530	286	.2008	9638	467	346	447	836	645	823	1086	386	909
64		1.218	.536	280	.1969	8500	480	341	446	872	596	867	1092	380	865
65		1.221	.547	280	.1852	6975	431	342	450	709	580	891	980	318	847
66	55,000	1.217	0.788	201	—	12,513	530	205	—	1125	737	1104	—	—	—
67		1.225	.795	198	.1732	12,019	509	208	448	1104	717	1065	1314	365	1075
68		1.223	.793	198	.1682	11,625	487	201	455	1049	711	1010	1257	329	1029
69		1.232	.806	197	.1686	11,088	472	202	458	981	698	846	1161	348	957
70		1.226	.806	197	.1693	10,937	431	202	456	844	674	813	1082	317	863
71		1.226	.800	197	.1706	9513	386	200	458	648	626	619	938	361	785
72		1.218	.530	199	.1334	12,513	417	239	456	522	762	692	1440	368	1203
73		1.201	.519	197	.1357	12,019	461	235	448	686	722	635	1378	314	1136
74		1.206	.531	202	.1361	11,625	482	241	456	656	715	603	1300	318	1070
75		1.206	.526	202	.1540	11,000	484	240	456	608	708	778	1258	305	1032
76		1.218	.545	203	.1361	10,937	381	246	455	732	661	706	1190	304	966
77		1.257	.565	201	.1564	9280	376	244	459	656	636	615	1161	342	952

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XJ34-WE-32 TURBOJET ENGINE - Concluded

1.902 square feet.

Engine inlet air flow $W_{a,2}$ (lb/sec)	Corrected engine inlet air flow $W_{a,2}\sqrt{\theta_2}/\delta_2$ (lb/sec)	Corrected engine speed $N/\sqrt{\theta_2}$ (rpm)	Compressor Mach number M_c	Compressor total-pressure ratio P_3/P_2	Adiabatic compressor efficiency η_c	Fuel-air ratio $\frac{W_f}{3600\,W_{a,2}}$	Combustor total-pressure loss coefficient $(P_3-P_4)/q_b$	Combustor total-pressure loss ratio $(P_3-P_4)/P_3$	Combustor total-temperature ratio T_4/T_3	Combustor efficiency η_b	Corrected turbine speed $N/\sqrt{\theta_4}$ (rpm)	Corrected turbine gas flow $\frac{W_{g,4}\sqrt{\theta_4}}{\delta_4(\gamma_4/1.4)}$ (lb/sec)	Turbine total-pressure ratio P_4/P_5	Adiabatic turbine efficiency η_t	Run
54.66	59.42	13,151	0.971	3.611	0.781	0.0090	2.969	0.0380	1.818	0.806	7830	29.62	2.638	0.848	1
55.74	59.82	13,151	.971	3.601	.775	.0088	2.948	.0383	1.791	.910	7870	29.67	2.596	.838	2
54.12	59.16	12,076	.905	3.411	.785	.0081	3.066	.0382	1.410	.902	7815	29.74	2.545	.835	3
53.37	57.80	12,147	.867	3.390	.813	.0082	3.161	.0428	1.748	.848	7582	29.67	2.477	.862	4
48.14	58.33	11,065	.818	2.938	.808	.0080	2.881	.0375	1.694	.769	7175	29.04	2.303	.841	5
36.62	40.10	9690	.718	2.388	.785	.0081	3.107	.0475	1.782	.684	6361	29.13	1.838	.864	6
30.71	33.13	8344	.616	1.814	.666	.0088	2.979	.0545	1.881	.665	5818	28.33	1.648	.867	7
26.72	24.65	6596	.486	1.436	.667	.0112	3.090	.0580	[illegible]	[illegible]	4581	27.14	1.482	[illegible]	8
[illegible]	[illegible]	12,551	0.954	3.455	0.785	0.0088	4.341	[illegible]	1.714	[illegible]	[illegible]	[illegible]	2.573	0.870	9
49.06	55.90	12,064	.929	3.435	.789	.0085	5.718	.0765	1.687	.877	7835	31.42	2.507	.858	10
46.36	55.91	11,675	.862	3.142	.810	.0079	5.840	.0798	1.634	.800	7688	31.42	2.445	.859	11
40.86	49.01	10,665	.786	2.637	.801	.0080	4.976	.0743	1.580	.881	7588	31.68	2.346	.824	12
32.02	38.89	8551	.686	2.084	.705	.0087	3.945	.0670	1.600	.812	6496	30.42	1.920	.858	13
25.35	30.37	7966	.588	1.636	.635	.0083	2.694	.0696	1.621	.586	5886	28.64	1.663	.858	14
18.87	22.65	6312	.465	1.375	.617	.0104	2.997	.0644	[illegible]	.465	4682	28.42	[illegible]	.780	15
56.13	59.13	12,750	0.988	3.601	0.777	0.0083	[illegible]	[illegible]	1.781	0.767	[illegible]	[illegible]	2.777	0.861	16
55.99	58.82	12,681	.956	3.507	.777	.0085	4.087	.0542	1.786	.784	8042	30.36	2.738	.779	17
55.91	57.00	11,236	.861	3.306	.801	.0088	3.677	.0521	1.576	.859	7689	30.71	2.788	.818	18
50.19	50.67	10,686	.804	2.690	.781	.0084	3.638	.0587	1.474	.812	7613	30.80	2.577	.841	19
33.40	40.53	9681	.706	2.004	.686	.0084	2.117	.0614	1.341	.375	7288	31.14	2.343	.867	20
16.46	33.12	8172	.605	1.511	.663	.0084	2.654	.0486	1.389	.365	6436	31.43	1.848	.806	21
14.84	28.47	6475	.476	1.134	.577	.0098	2.960	.0511	1.380	.175	5454	32.80	1.448	.880	22
55.71	59.68	13,351	.956	3.656	.763	.0101	3.115	.0409	1.796	.776	8047	29.71	2.663	.818	23
54.81	57.36	13,376	.967	3.637	.780	.0108	3.344	.0435	1.808	.773	8047	29.68	2.663	.818	24
57.59	59.11	12,343	.911	3.407	.785	.0087	3.576	.0469	1.883	.598	7767	29.62	2.613	.880	25
55.40	55.19	11,264	.836	2.970	.785	.0087	2.588	.0417	1.683	.560	7406	29.41	2.476	.880	26
50.12	42.35	9647	.737	2.390	.738	.0106	3.185	.0484	1.575	.446	6804	28.63	2.101	.849	27
18.63	33.67	8440	.603	1.732	.655	.0121	3.182	.0436	1.883	.386	5664	28.31	1.769	.803	28
11.74	24.67	6461	.443	1.336	.617	.0139	2.908	.0357	1.880	.341	4512	27.32	1.438	.867	29
25.47	59.56	13,436	.951	3.669	.763	.0107	2.618	.0385	1.588	.786	7815	29.36	2.571	.834	30
24.67	58.36	13,376	.967	3.686	.763	.0108	3.375	.0427	1.585	.786	7806	29.77	2.543	.830	31
24.55	56.62	12,343	.911	3.455	.787	.0104	3.314	.0438	1.767	.887	7832	30.06	2.481	.842	32
23.17	54.73	11,865	.833	3.073	.808	.0104	3.416	.0480	1.714	.806	7858	30.45	2.328	.884	33
17.86	41.62	9712	.732	2.361	.744	.0132	2.727	.0503	1.763	.513	6457	29.73	1.877	.865	34
13.48	32.15	8486	.667	1.884	.665	.0144	4.077	.0481	1.841	.480	5673	28.73	1.604	.815	35
10.37	24.65	6718	.486	1.444	.632	.0184	2.482	.0646	2.080	.446	4381	27.69	1.404	.834	36
[illegible]	59.61	13,061	0.964	3.519	0.768	0.0176	[illegible]	[illegible]	1.786	0.736	7980	30.77	[illegible]	0.779	37
20.06	55.16	13,086	.969	3.527	.782	.0119	3.656	.0389	1.759	.894	7980	30.74	2.614	.777	38
22.59	57.85	12,006	.867	3.270	.785	.0098	3.001	.0430	1.587	.818	7777	30.64	2.664	.793	39
15.81	50.69	10,948	.808	2.702	.757	.0098	2.977	.0443	1.472	.648	7808	31.06	2.736	.818	40
15.71	40.53	9643	.705	1.906	.643	.0088	3.064	.0471	1.385	.813	7867	31.86	2.313	.880	41
15.01	40.86	9616	.710	1.815	.627	.0087	3.002	.0480	1.388	.880	7845	31.76	2.366	.886	42
17.78	58.63	13,401	.969	—	—	.0122	—	—	—	.889	—	—	—	—	43
18.01	59.14	13,436	.962	3.567	.748	.0130	2.944	.0375	1.587	.884	7896	29.41	2.773	.784	44
17.86	56.65	12,343	.911	3.371	.778	.0113	3.580	.0411	1.665	.886	7787	30.81	2.781	.834	45
16.97	55.54	11,866	.835	—	—	.0111	—	—	—	.436	—	—	—	—	46
12.63	41.62	9675	.735	—	—	.0122	—	—	—	.389	—	—	—	—	47
9.98	33.66	8486	.667	—	—	.0140	—	—	—	.307	—	—	—	—	48
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	49
14.01	59.11	13,401	.968	3.706	.736	.0138	2.645	.0334	1.680	.631	7866	29.87	2.668	.801	50
13.90	58.57	12,366	.913	3.465	.763	.0136	2.784	.0377	1.780	.580	7686	29.61	2.615	.814	51
12.73	53.64	11,284	.836	3.094	.763	.0131	—	—	1.678	.468	7778	28.06	2.665	.793	52
9.93	42.66	9676	.739	2.387	.711	.0150	—	—	1.687	.378	6809	27.06	2.380	.765	53
—	—	—	—	1.705	—	—	—	.1446	—	—	—	—	—	—	54
—	—	—	—	1.557	—	—	—	[illegible]	—	—	—	—	—	—	55
12.35	59.33	13,436	0.962	3.513	0.743	0.0148	3.003	[illegible]	1.803	0.818	7781	29.31	2.746	0.787	56
10.45	58.66	13,451	.964	3.567	.736	.0133	3.215	.0387	1.881	.894	7813	29.19	2.698	.798	57
9.67	55.63	13,486	.961	3.706	.721	.0151	3.117	.0367	1.807	.813	7768	29.59	2.706	.781	58
9.00	58.44	12,800	.958	3.671	.762	.0147	3.964	.0378	1.868	.577	7646	29.61	2.687	.802	59
10.35	57.65	12,336	.913	3.480	.757	.0155	2.781	.0412	1.818	.819	7484	30.79	2.566	.804	60
8.90	56.71	12,218	.906	3.460	.771	.0155	4.287	.0407	1.780	.471	7478	29.32	2.596	.839	61
6.39	52.33	11,447	.845	3.116	.768	.0156	6.985	.0443	1.721	.480	7861	29.98	2.476	.817	62
4.62	47.57	10,705	.390	2.661	.739	.0159	7.785	.0256	1.684	.377	6864	30.61	2.301	.838	63
10.36	32.35	8172	.677	1.871	.641	.0198	.1961	.0076	1.718	.395	6133	29.63	2.021	.780	64
10.02	37.69	7284	.646	1.5[illegible]	.626	[illegible]	—	—	1.748	.365	5318	27.6[illegible]	1.881	.748	65
—	—	—	—	3.776	0.717	—	—	0.0376	—	—	—	—	—	—	66
8.04	59.66	12,939	.966	3.662	.747	.0156	2.771	.0385	1.630	.834	7896	29.63	2.781	.763	67
8.59	58.84	12,416	.917	3.465	.763	.0151	2.835	.0378	1.762	.467	7806	29.86	2.787	.790	68
8.62	55.30	11,821	.875	3.348	.786	.0154	2.814	.0387	1.718	.438	7437	29.41	2.711	.807	69
7.82	51.36	11,843	.830	3.768	.723	.0153	2.454	.0379	1.608	.384	7384	30.67	2.581	.830	70
5.63	35.77	9674	.736	2.180	.663	.0187	3.886	.0448	1.610	.381	7008	27.86	2.372	.767	71
6.99	58.14	13,314	.985	3.652	.734	.0186	2.344	.0385	1.941	.800	7630	28.39	2.730	.779	72
6.82	57.55	12,939	.959	3.618	.757	.0184	3.021	.0386	1.804	.497	7640	29.96	2.680	.774	73
5.89	54.70	12,887	.906	3.440	.744	.0170	2.385	.0314	1.814	.477	7481	29.77	2.574	.808	74
6.57	54.42	11,704	.864	3.367	.776	.0179	3.306	.0408	1.781	.436	7808	29.86	2.580	.801	75
6.37	51.30	11,884	.831	2.676	.737	.0176	2.681	.0389	1.747	.406	7078	29.99	2.443	.790	76
4.87	39.14	9676	.729	2.176	.608	.0216	2.887	.0474	1.787	.307	6378	30.58	2.136	.839	77

[redacted]

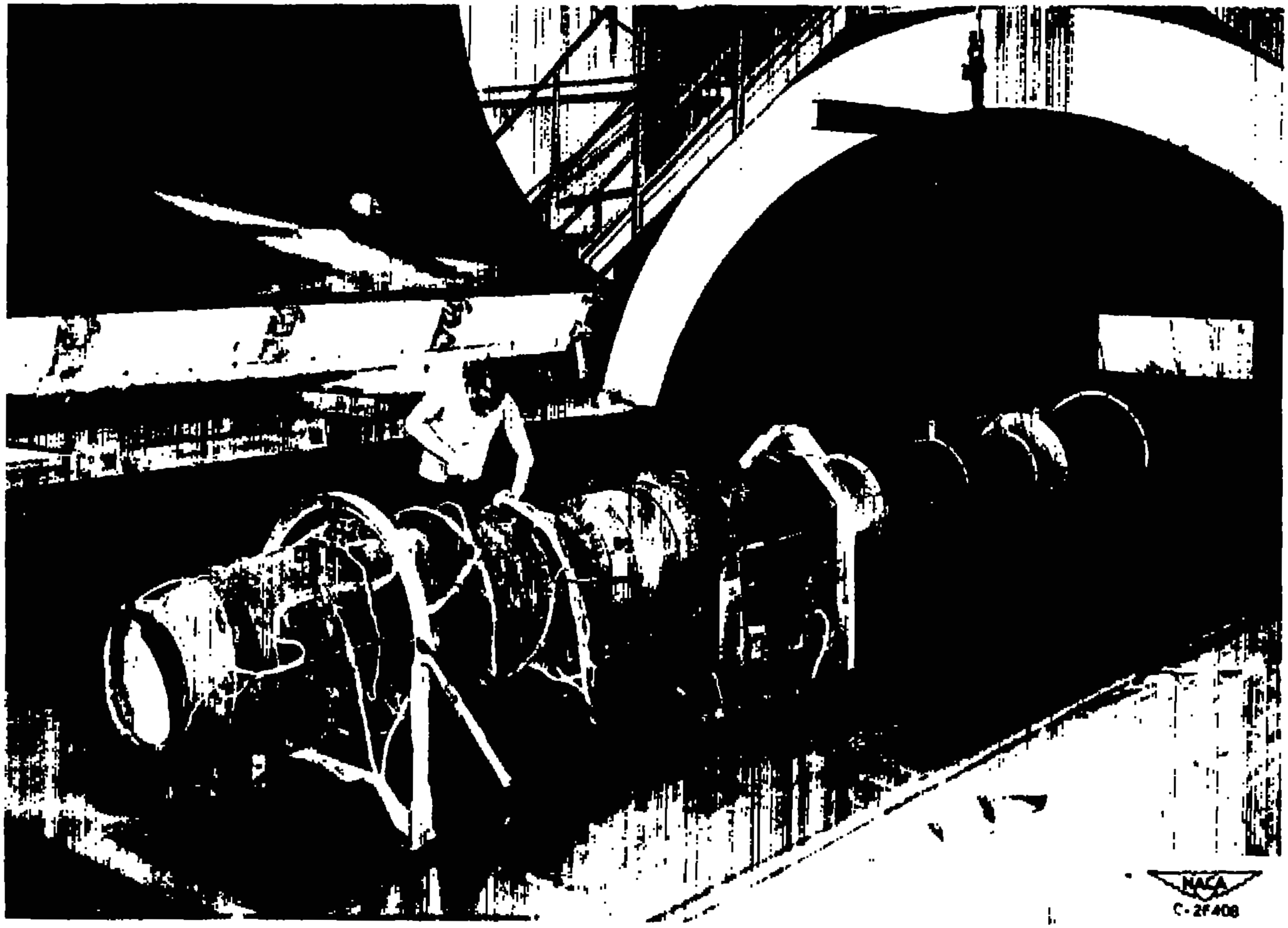


Figure 1. - XJ34-WE-32 turbojet engine installed in test section of altitude wind tunnel.

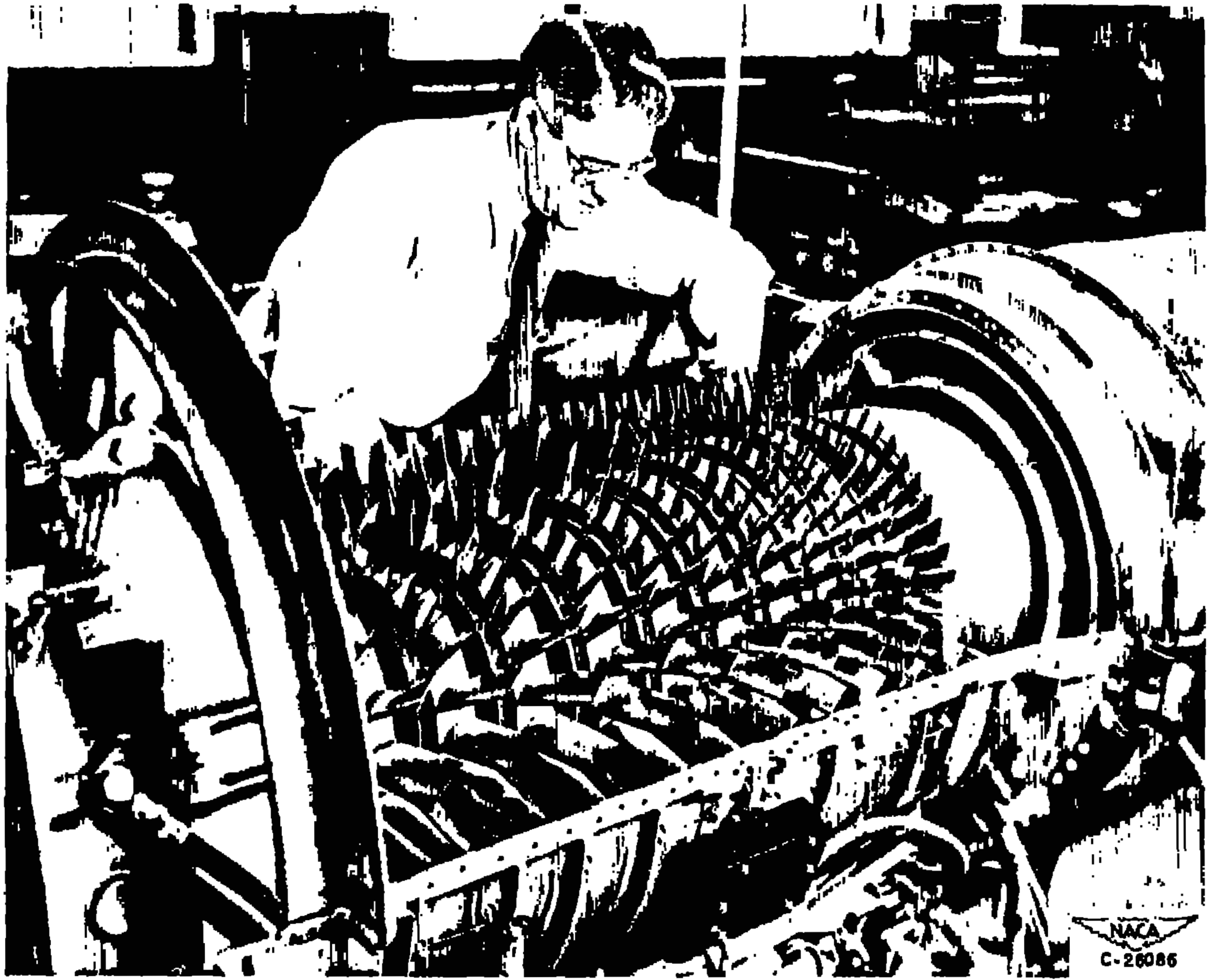


Figure 2. - Eleven-stage axial-flow compressor.

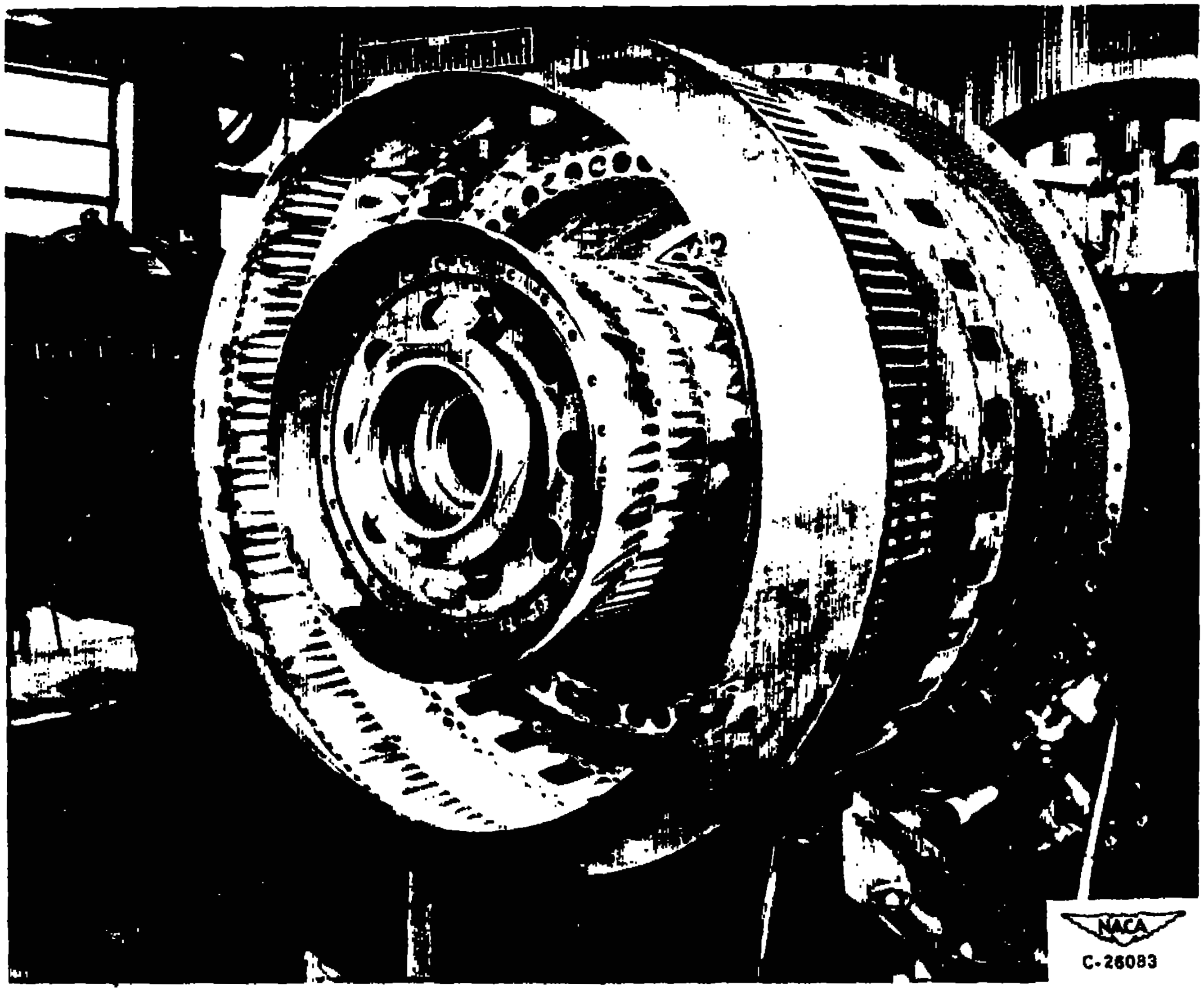


Figure 3. - Combustor (view looking upstream).

2456

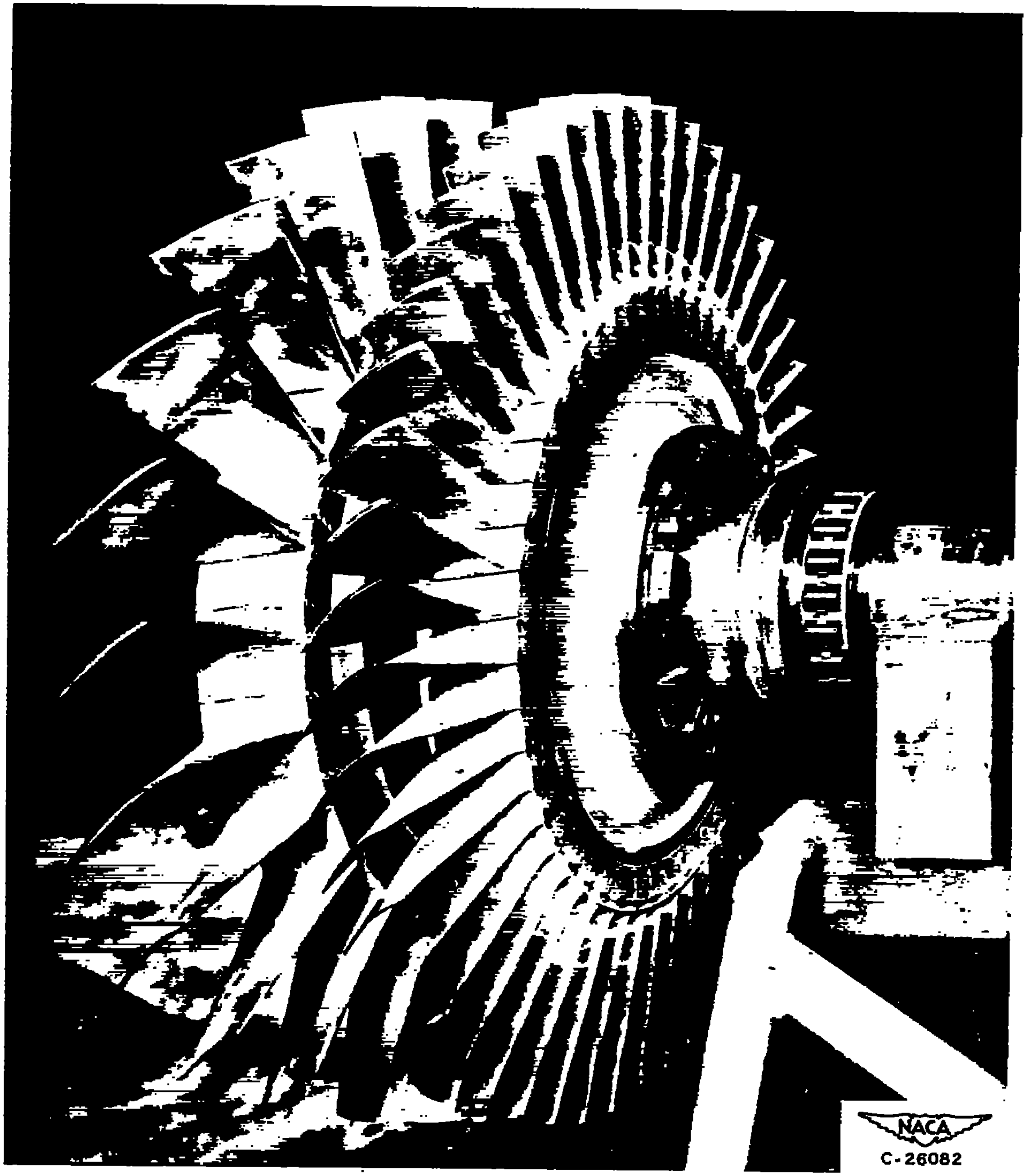


Figure 4. - Turbine rotors.

[redacted]

Station	Total-pressure tubes	Static-pressure tubes	Thermocouples
1	17	5	9
2	16	10	8
3	15	3	3
4	5	--	--
5	21	6	36
7	30	20	30

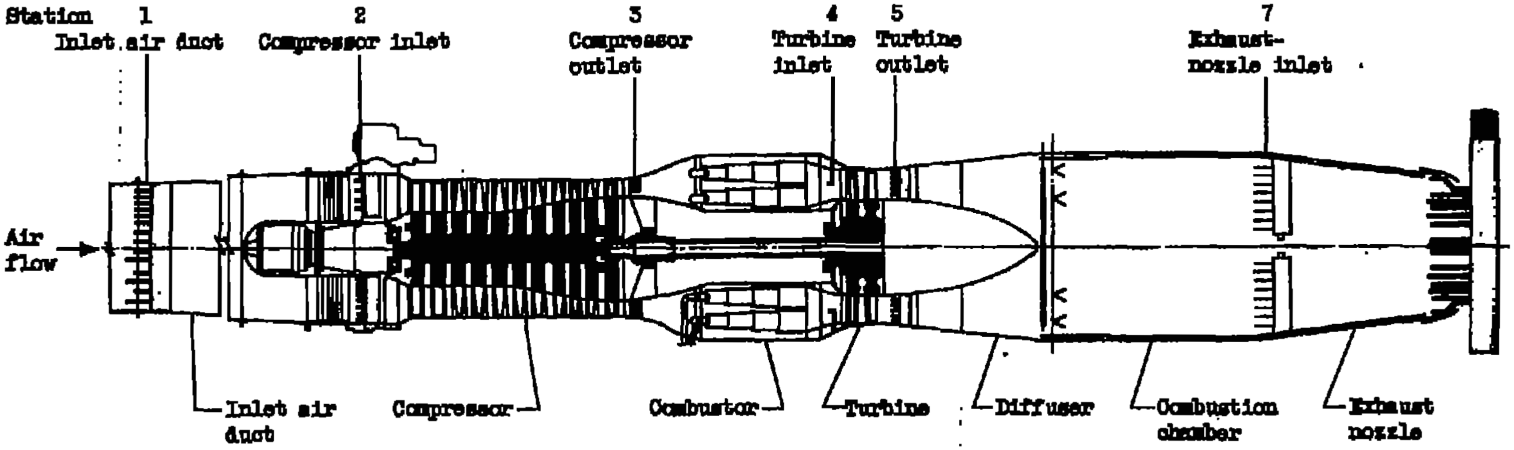
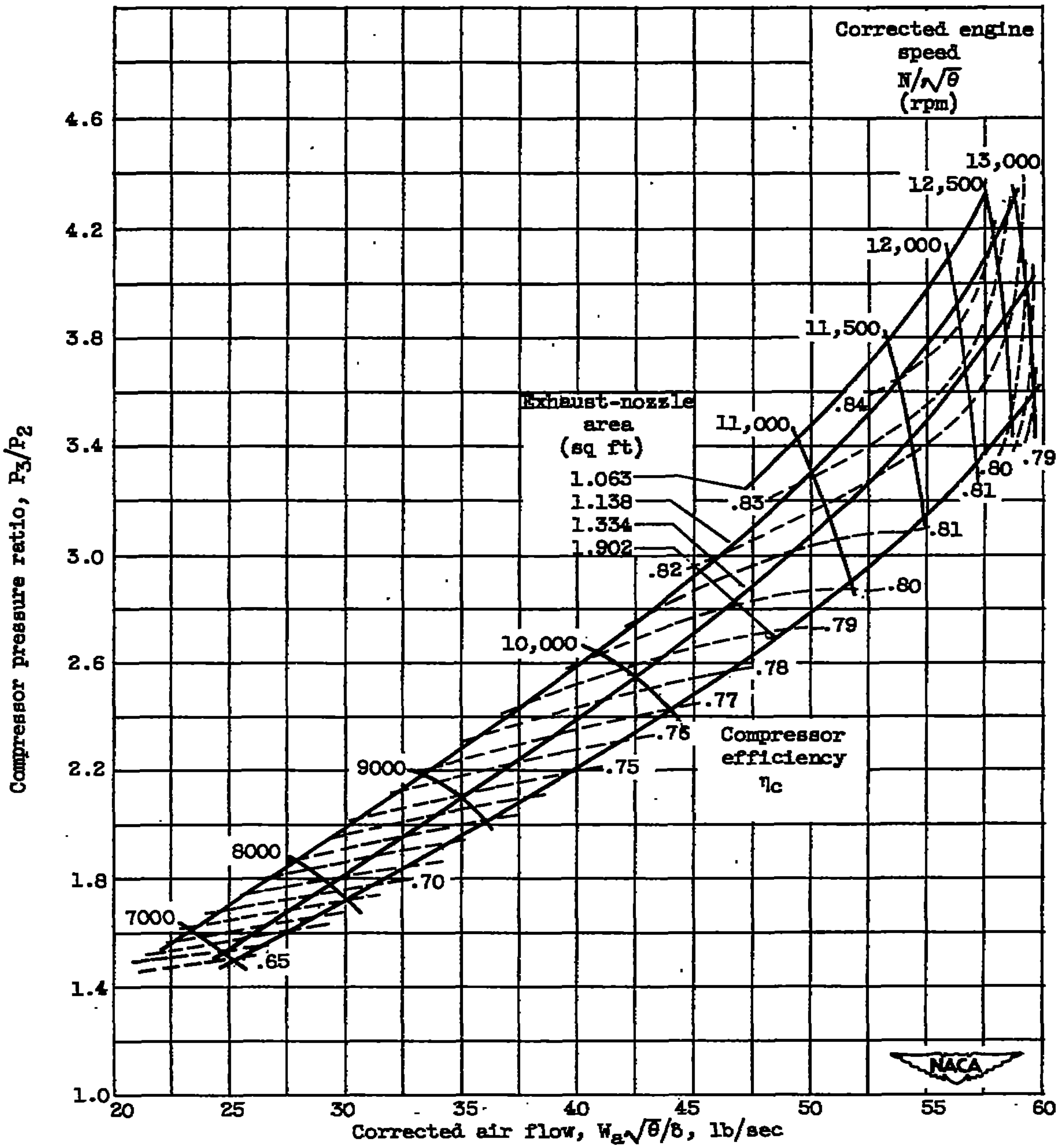


Figure 5. - Cross section of engine showing location of instrumentation.

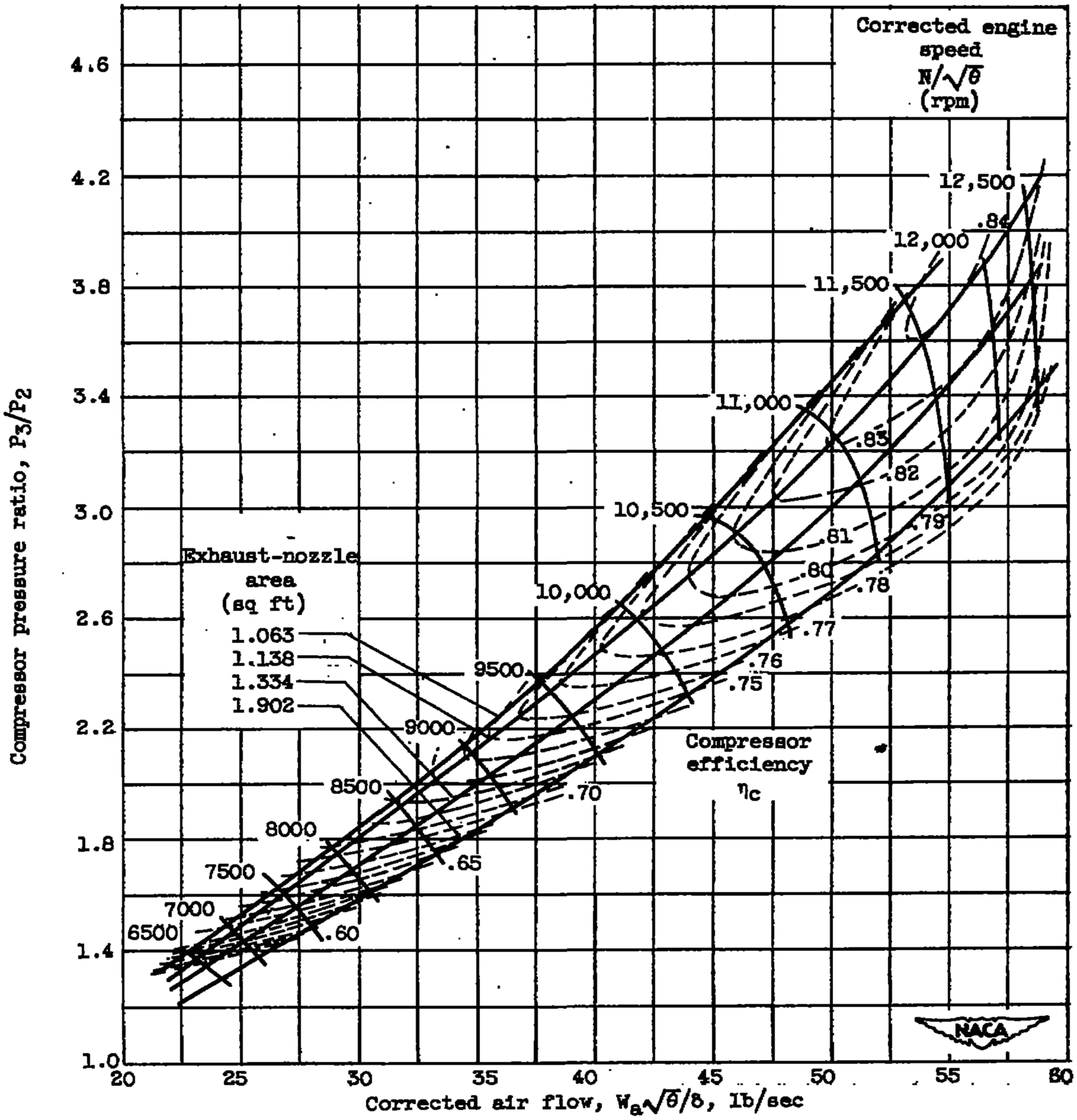
2456



(a) Flight Mach number, 0.28; altitude, 5000 feet; Reynolds number index, 1.008.

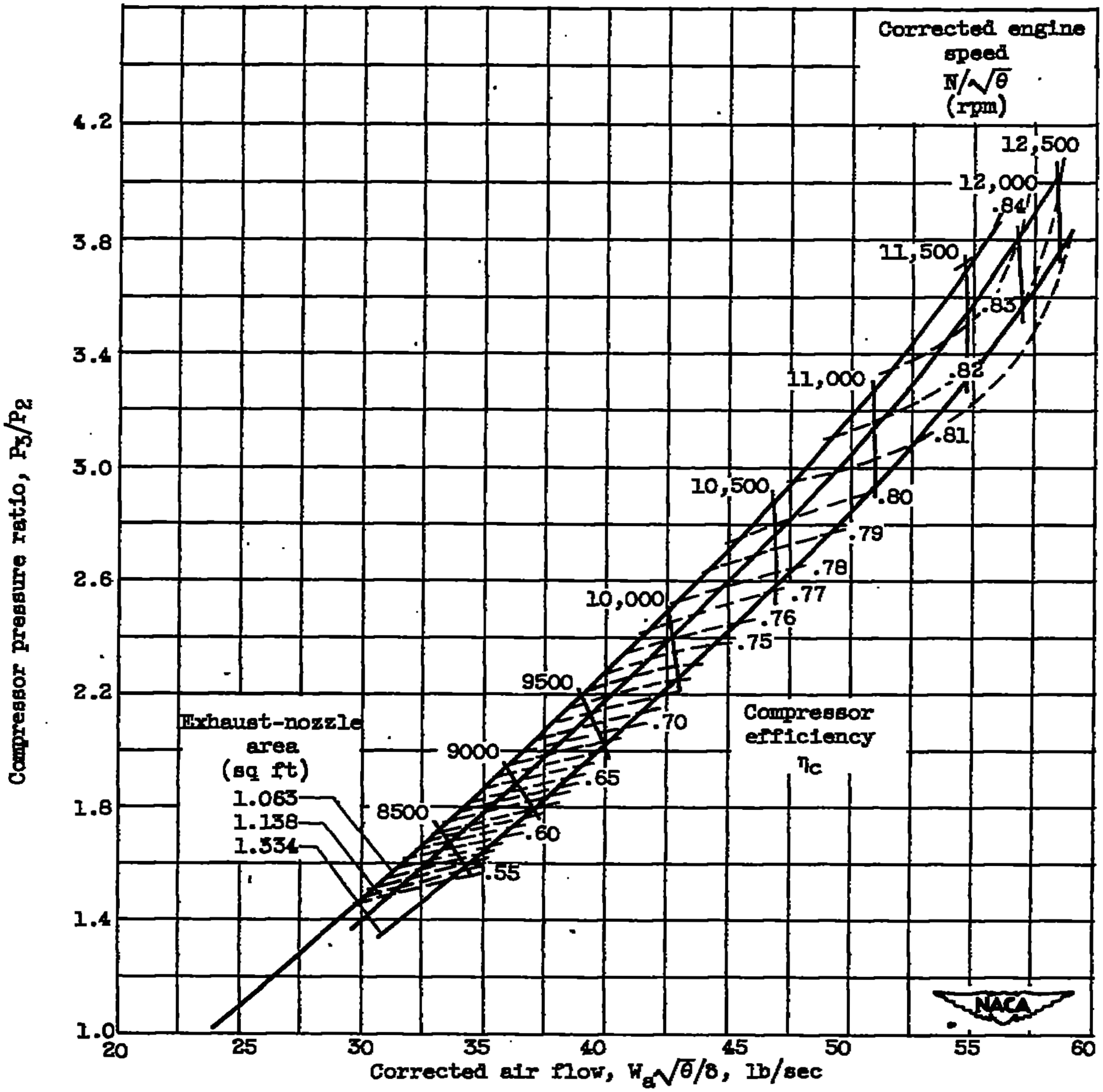
Figure 6. - Compressor performance map.

2456



(b) Flight Mach number, 0.53; altitude, 10,000 feet; Reynolds number index, 0.857.

Figure 6. - Continued. Compressor performance map.

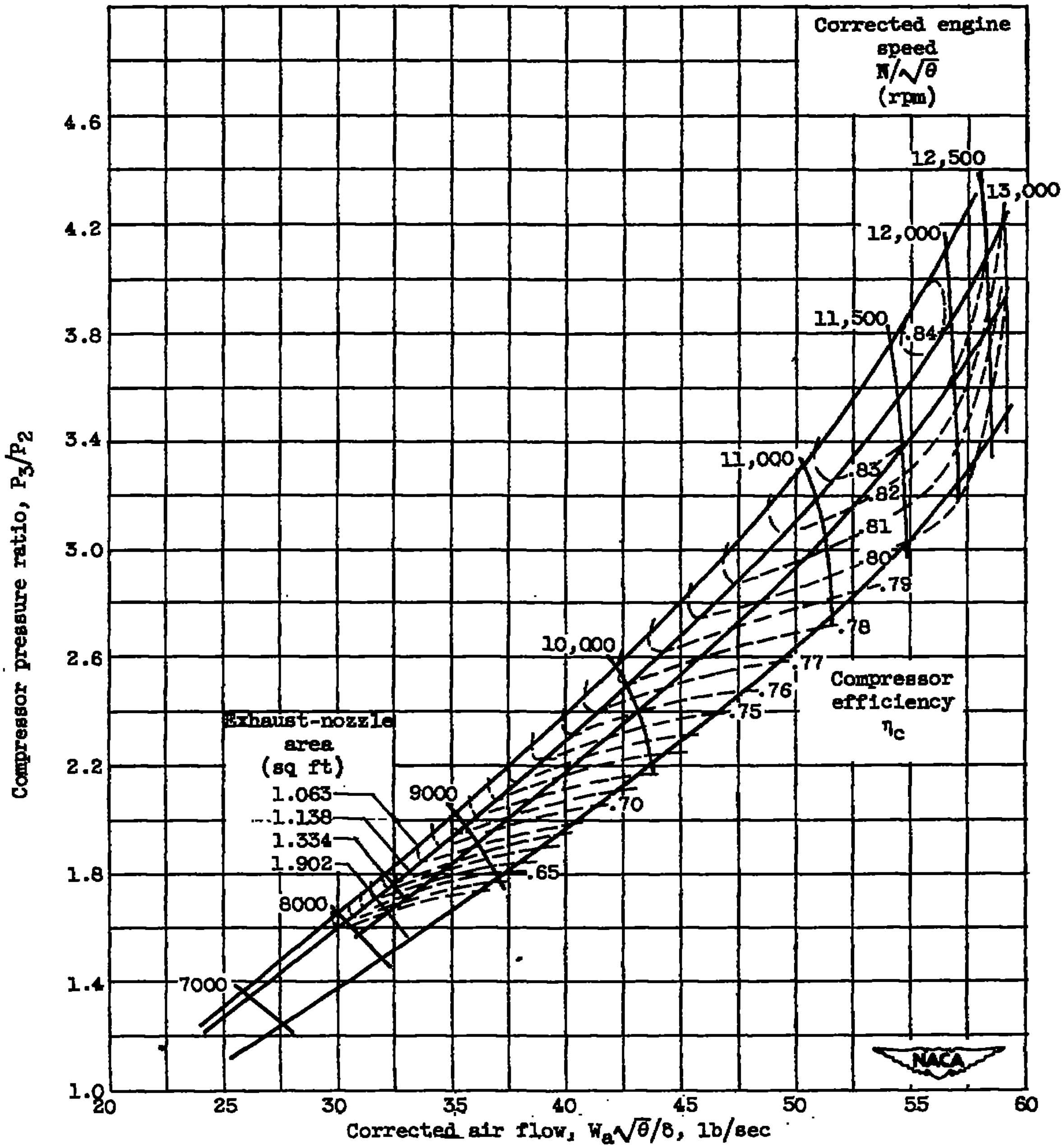


(c) Flight Mach number, 1.05; altitude, 25,000 feet; Reynolds number index, 0.739.

Figure 6. - Continued. Compressor performance map.

[redacted]

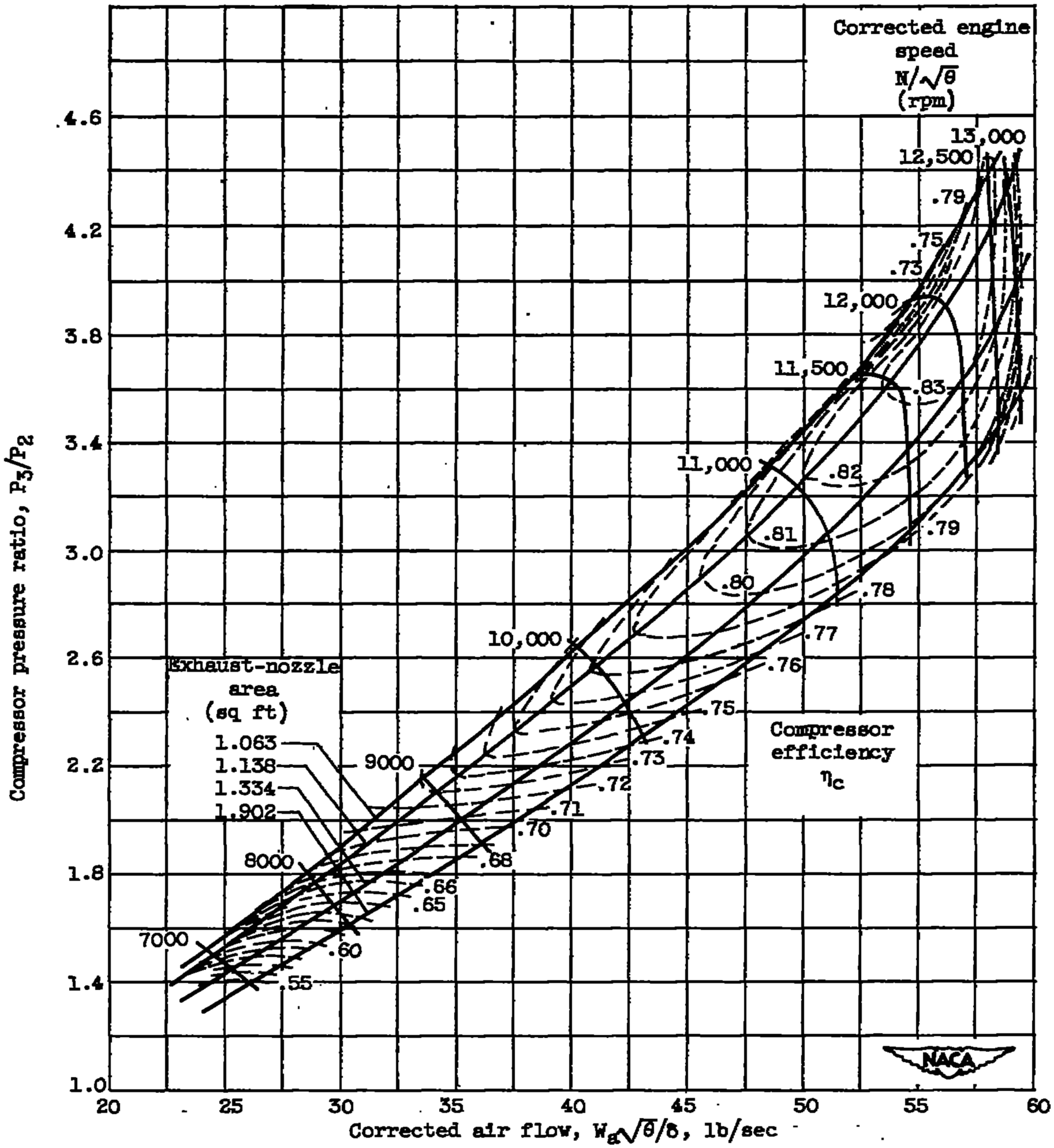
2456



(d) Flight Mach number, 0.79; altitude, 25,000 feet; Reynolds number index, 0.616.

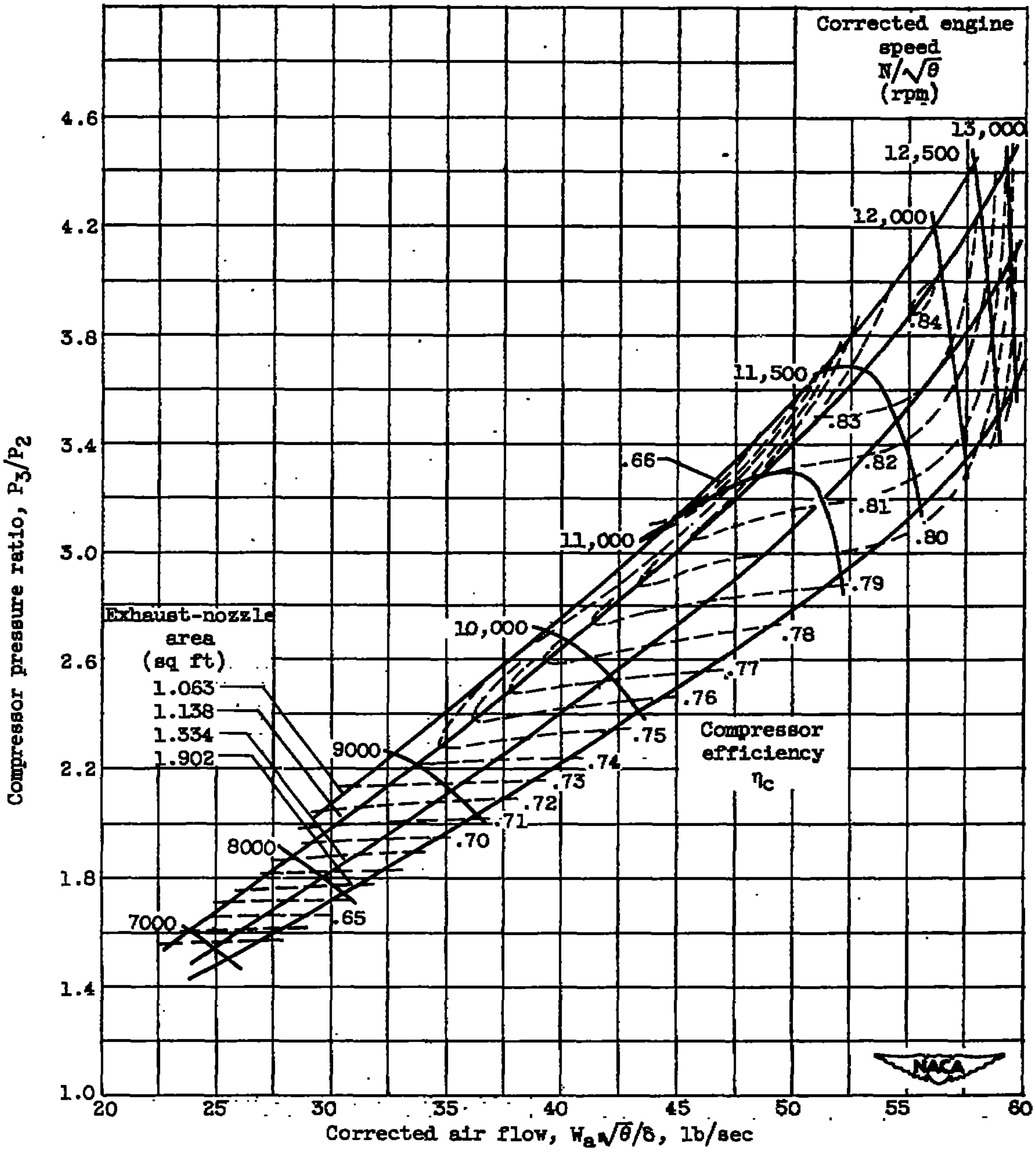
Figure 6. - Continued. Compressor performance map.

2456



(e) Flight Mach number, 0.53; altitude, 25,000 feet; Reynolds number index, 0.534.

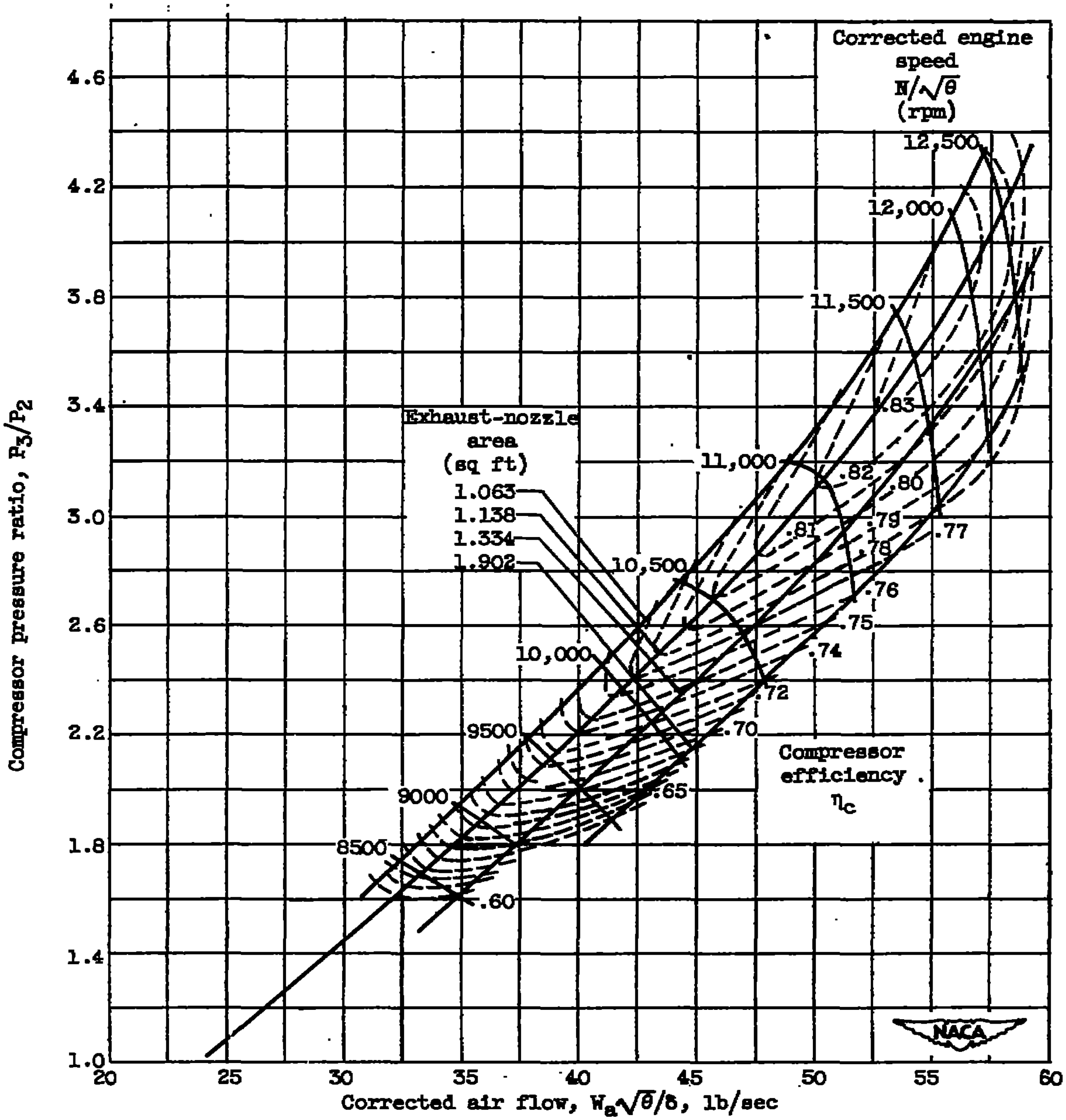
Figure 6. - Continued. Compressor performance map.



(f) Flight Mach number, 0.28; altitude, 25,000 feet; Reynolds number index, 0.470.

Figure 6. - Continued. Compressor performance map.

[redacted]

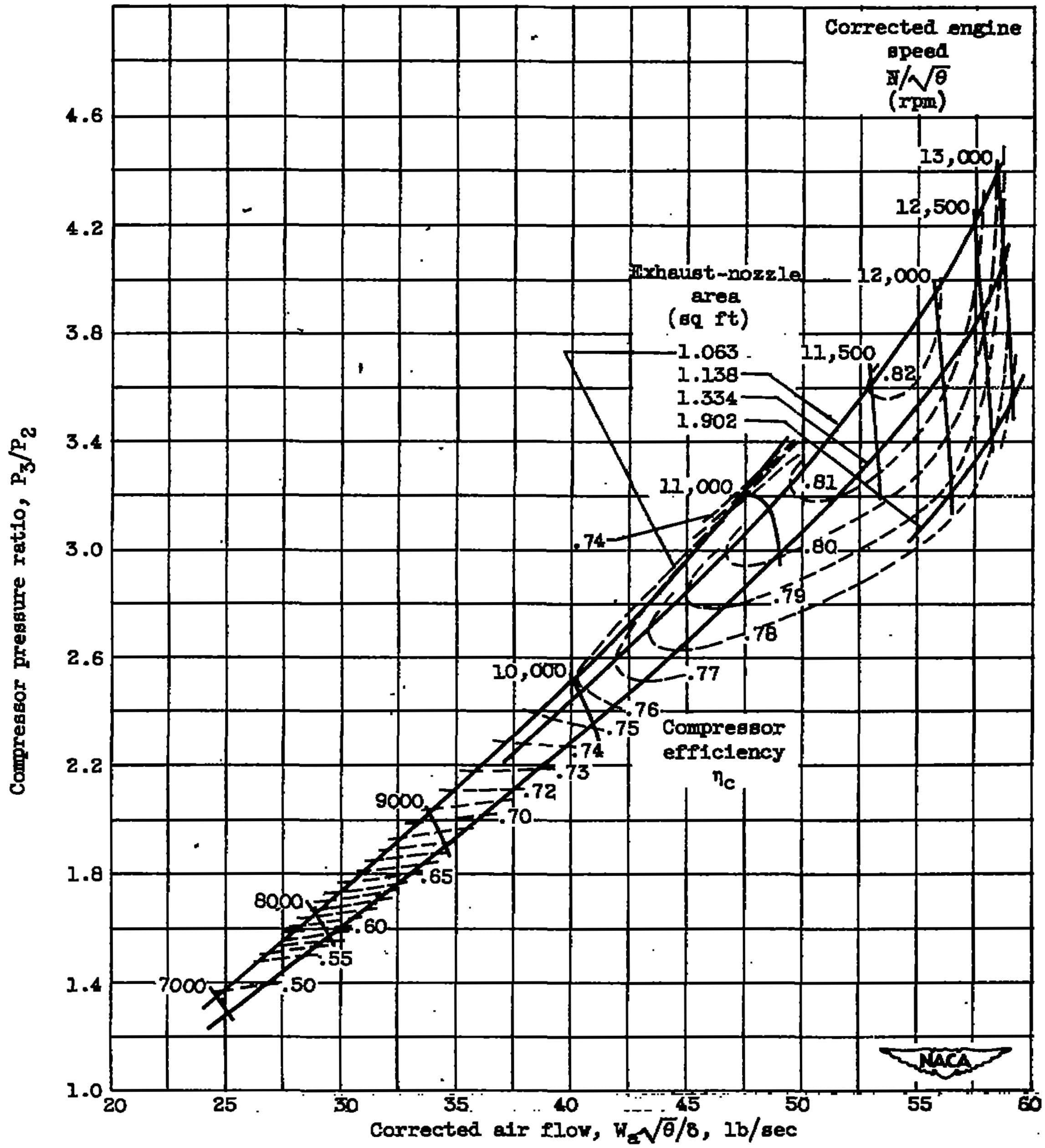


(g) Flight Mach number, 1.05; altitude, 40,000 feet; Reynolds number index, 0.417.

Figure 6. - Continued. Compressor performance map.

[redacted]

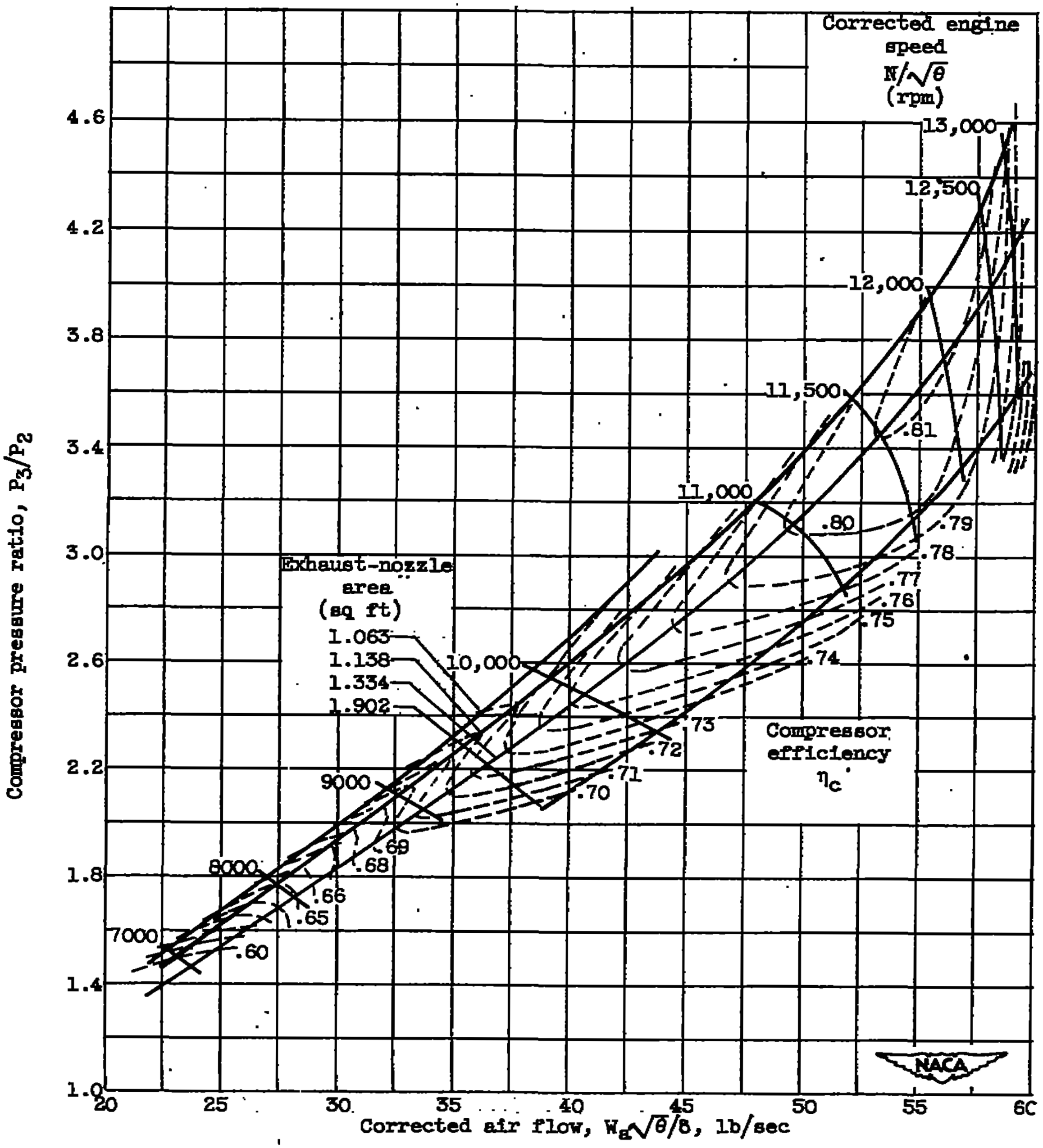
2456



(h) Flight Mach number, 0.79; altitude, 40,000 feet; Reynolds number index, 0.338.

Figure 6. - Continued. Compressor performance map.

[redacted]

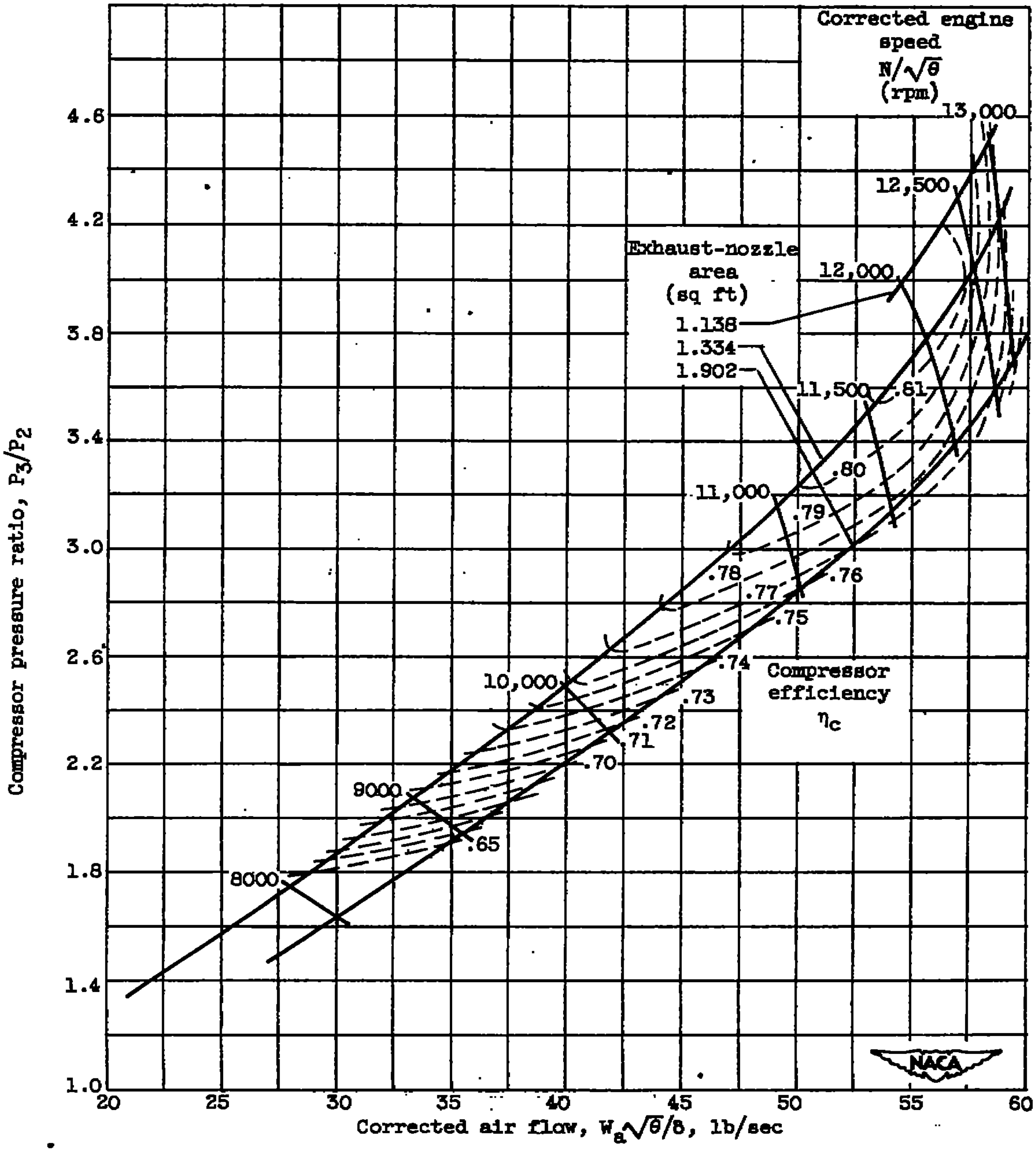


(i) Flight Mach number, 0.53; altitude, 40,000 feet; Reynolds number index, 0.268.

Figure 6. - Continued. Compressor performance map.

[redacted]

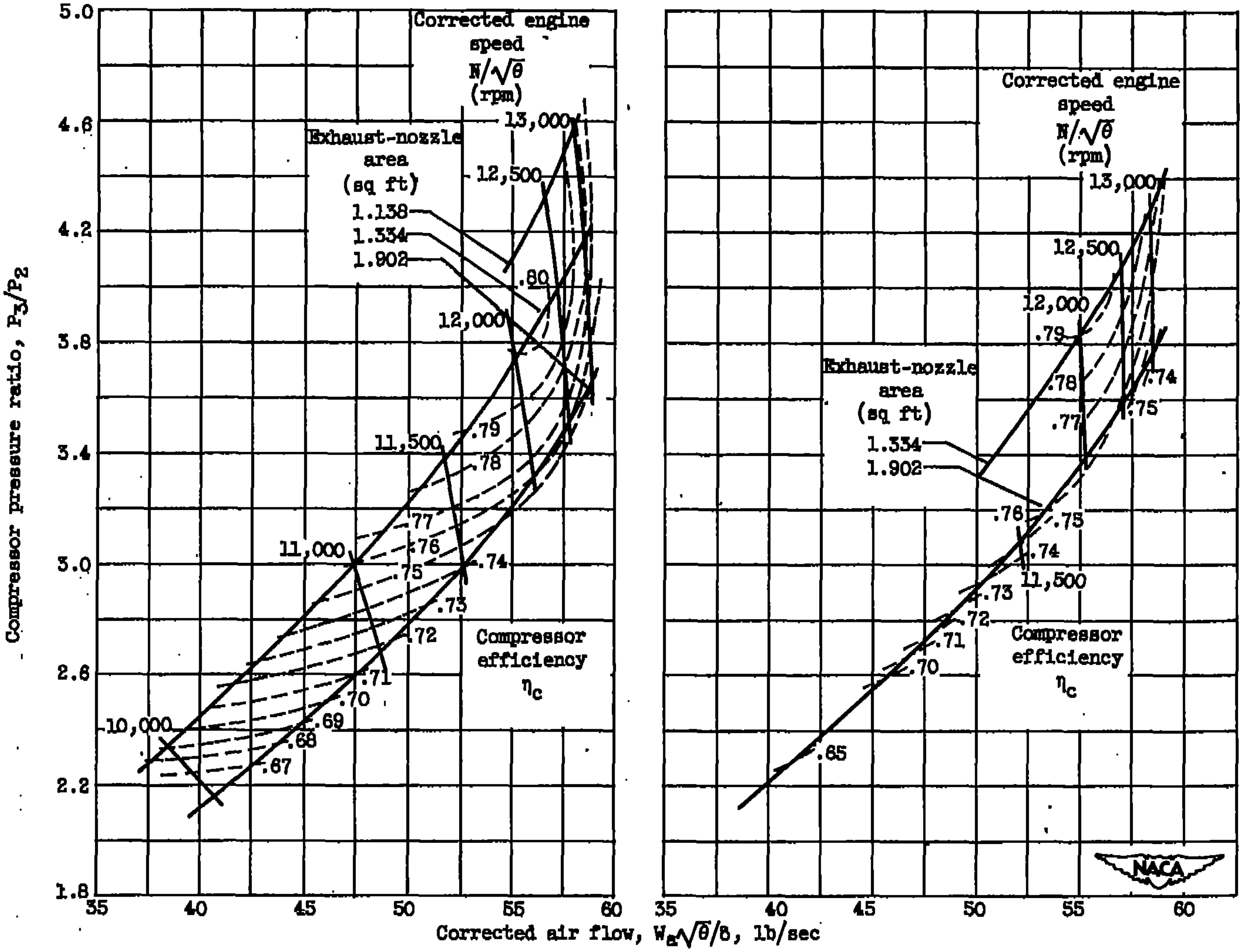
2456



(j) Flight Mach number, 0.53; altitude, 47,000 feet; Reynolds number index, 0.196.

Figure 6. - Continued. Compressor performance map.

[redacted]

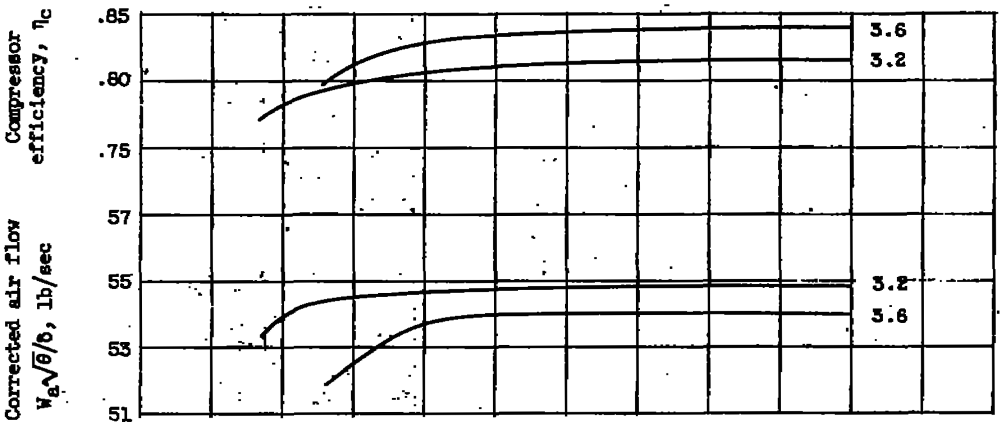


(k) Flight Mach number, 0.79; altitude, 55,000 feet; Reynolds number index, 0.170.

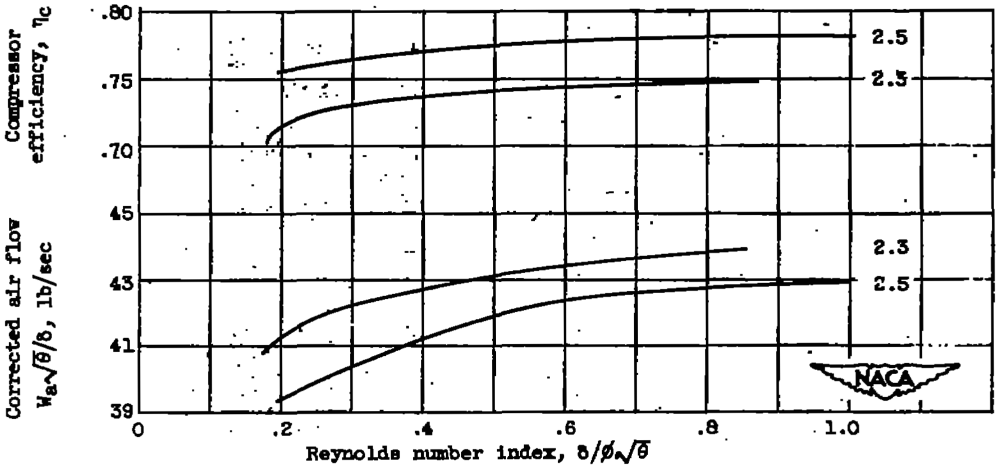
(l) Flight Mach number, 0.53; altitude, 55,000 feet; Reynolds number index, 0.136.

Figure 6. - Concluded. Compressor performance map.

(a) Corrected engine speed, 12,500 rpm.



(b) Corrected engine speed, 11,500 rpm.



(c) Corrected engine speed, 10,000 rpm.

Figure 7. - Effect of Reynolds number index on compressor performance.

[redacted]

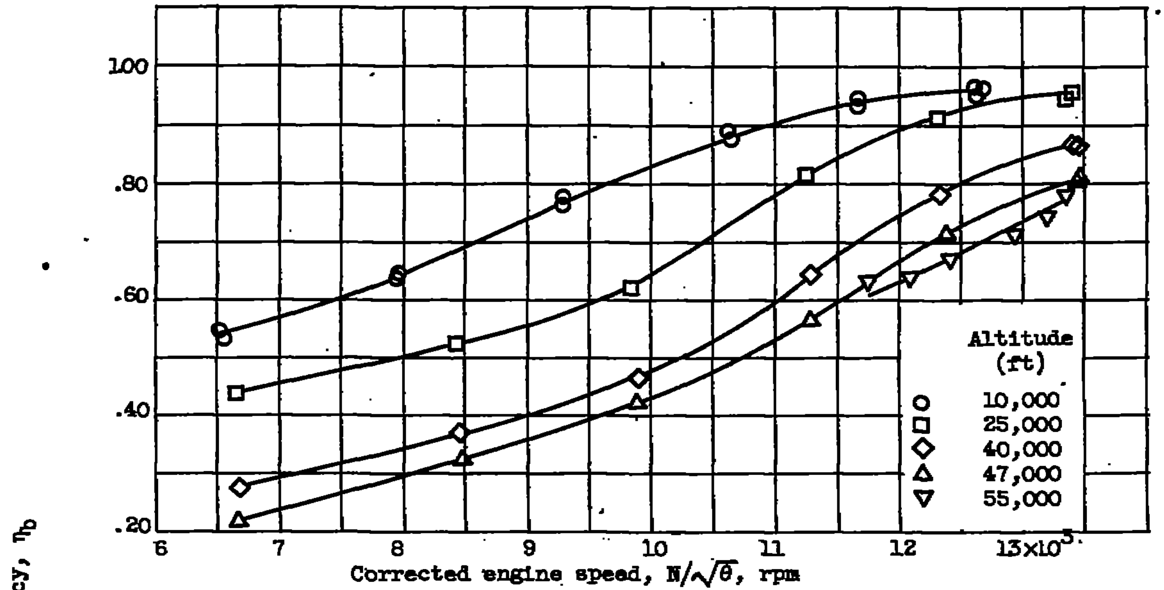


Figure 8. - Effect of corrected engine speed and altitude on combustion efficiency. Flight Mach number, 0.53; exhaust-nozzle area, 1.334 square feet.

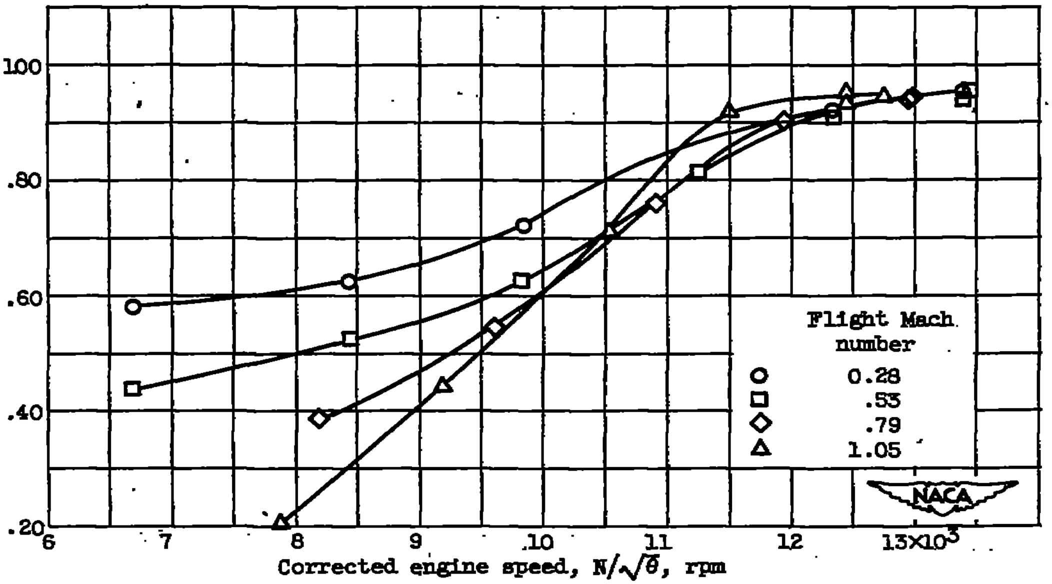


Figure 9. - Effect of corrected engine speed and flight Mach number on combustion efficiency. Altitude, 25,000 feet; exhaust-nozzle area, 1.334 square feet.

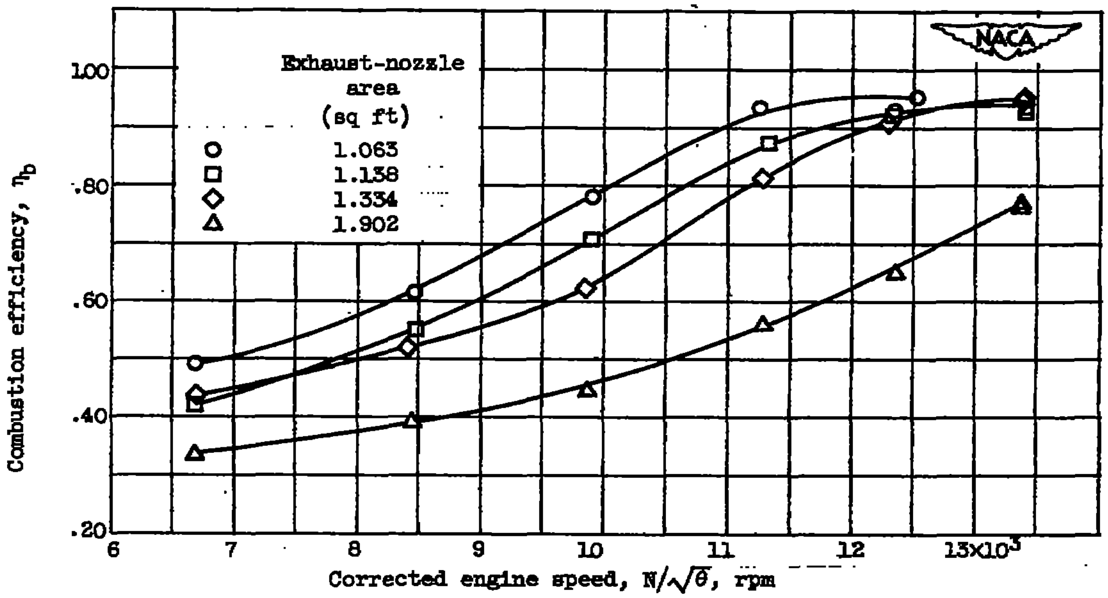


Figure 10. - Effect of corrected engine speed and exhaust-nozzle area on combustion efficiency. Altitude, 25,000 feet; flight Mach number, 0.53.

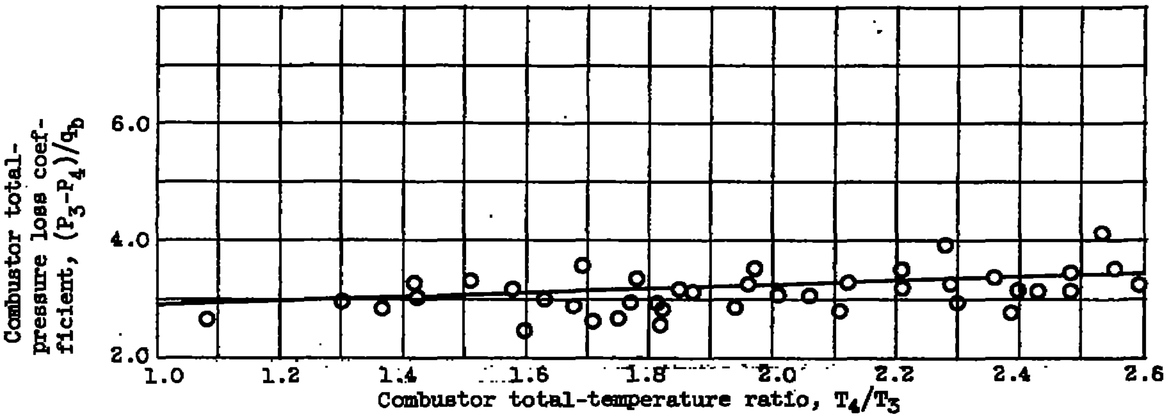
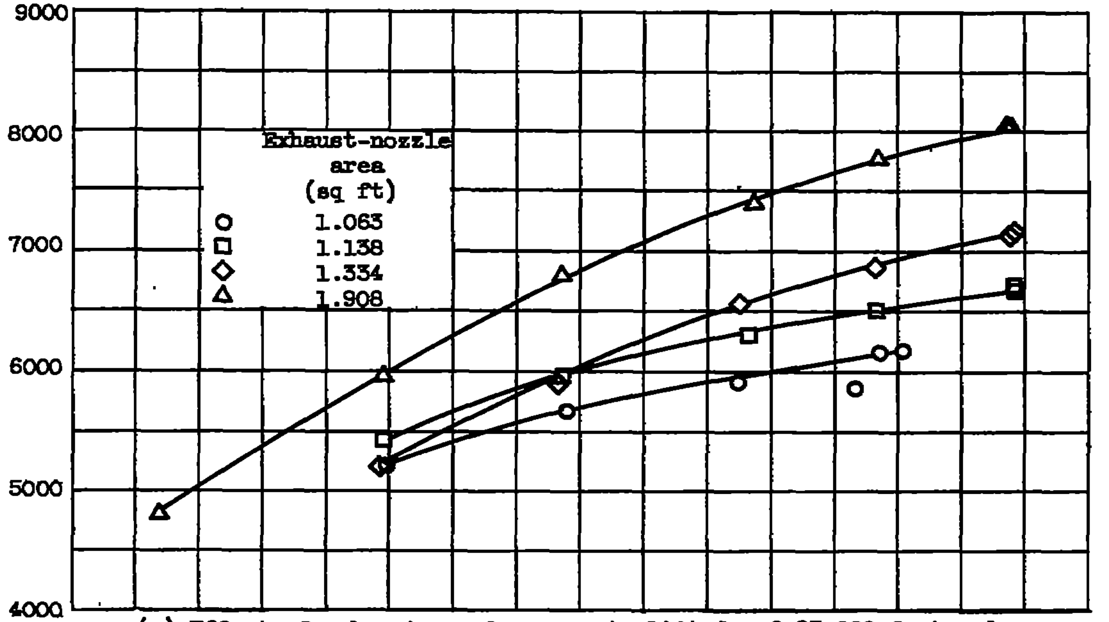


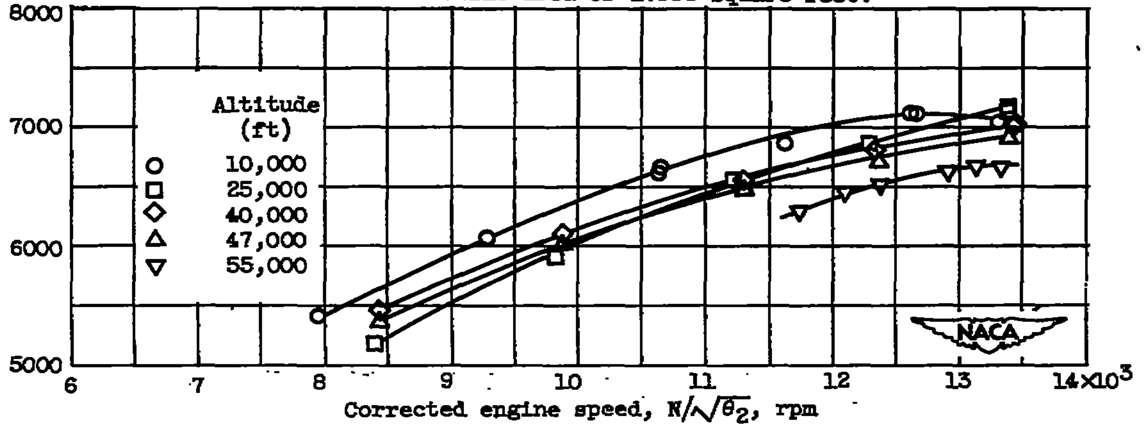
Figure 11. - Variation of combustor total-pressure loss coefficient with combustor temperature ratio.

[redacted]



(a) Effect of exhaust-nozzle area at altitude of 25,000 feet and flight Mach number of 0.53.

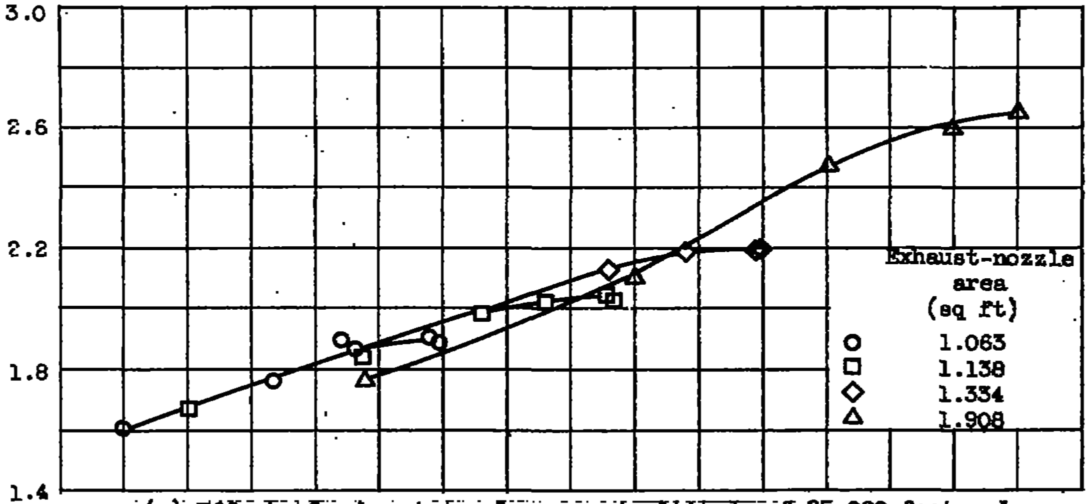
(b) Effect of flight Mach number at altitude of 25,000 feet and exhaust-nozzle area of 1.334 square feet.



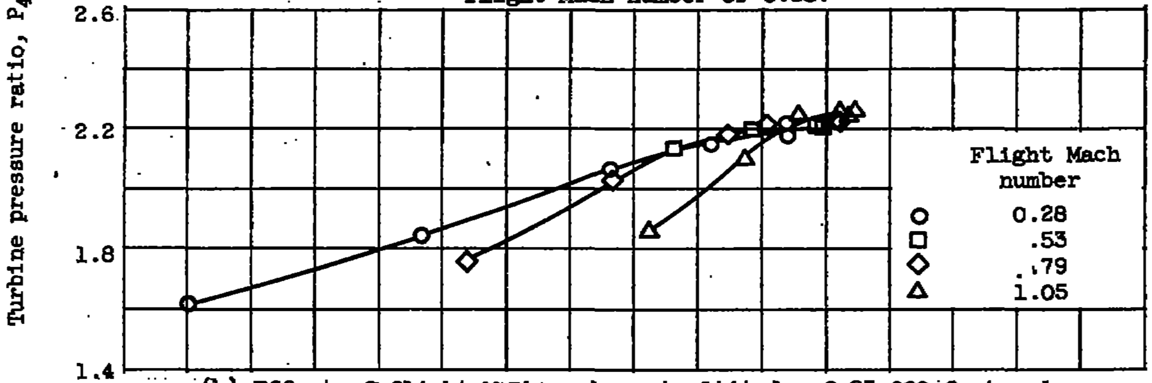
(c) Effect of altitude at flight Mach number of 0.53 and exhaust-nozzle area of 1.334 square feet.

Figure 12. - Effect of corrected engine speed, exhaust-nozzle area, flight Mach number, and altitude on corrected turbine speed.

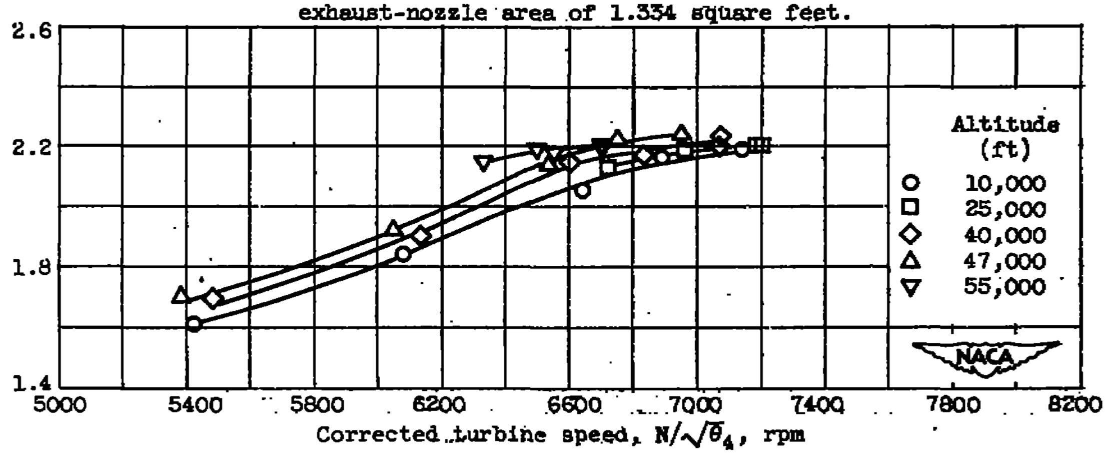
[redacted]



(a) Effect of exhaust-nozzle area at altitude of 25,000 feet and flight Mach number of 0.53.

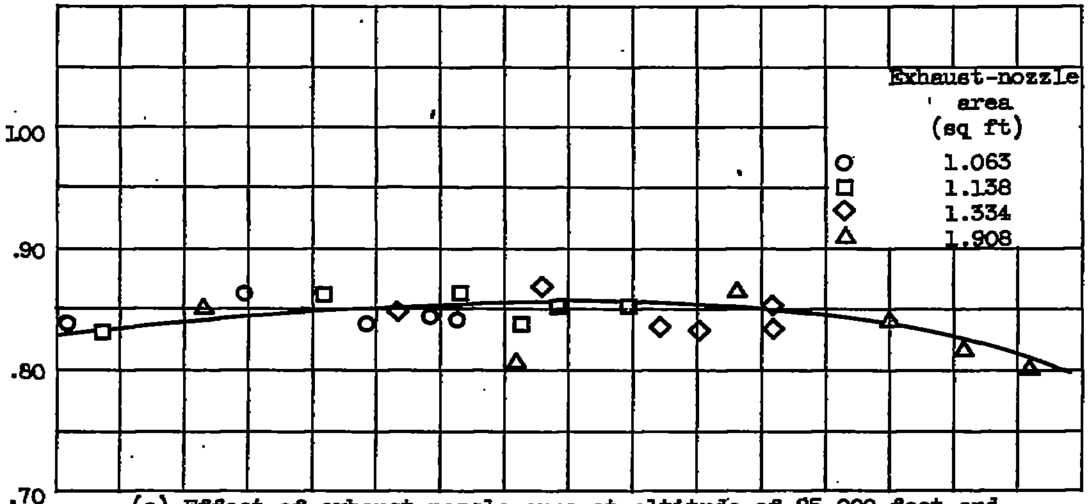


(b) Effect of flight Mach number at altitude of 25,000 feet and exhaust-nozzle area of 1.334 square feet.

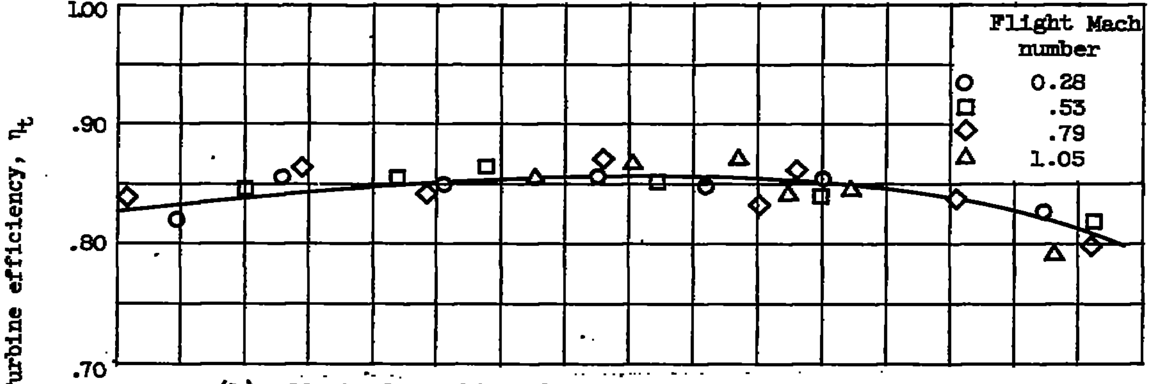


(c) Effect of altitude at flight Mach number of 0.53 and exhaust-nozzle area of 1.334 square feet.

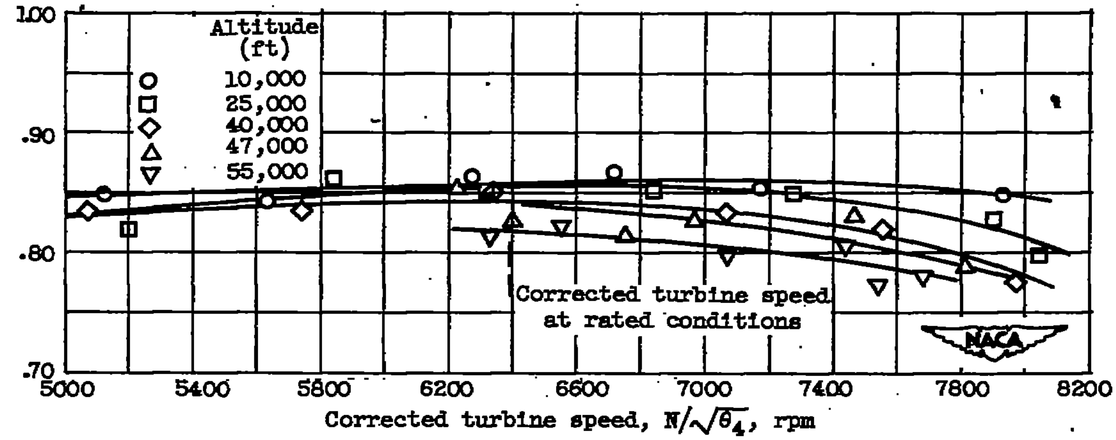
Figure 13. - Effect of corrected turbine speed, exhaust-nozzle area, flight Mach number, and altitude on turbine pressure ratio.



(a) Effect of exhaust-nozzle area at altitude of 25,000 feet and flight Mach number of 0.79.



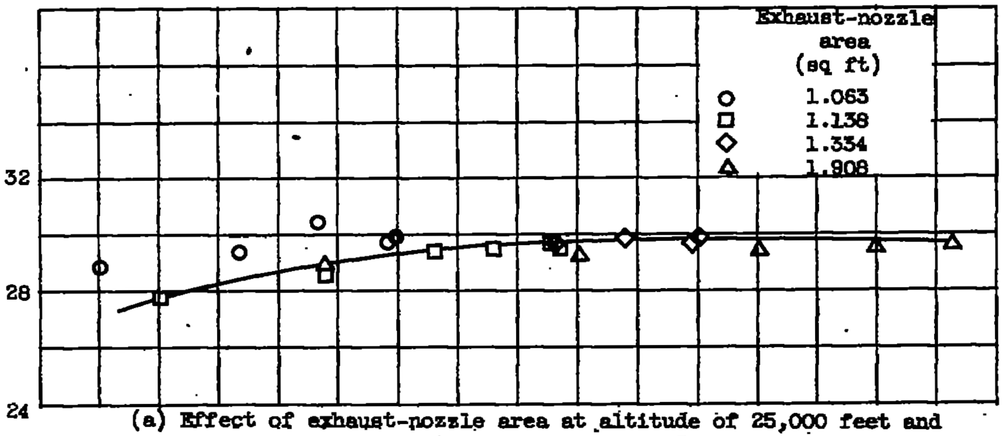
(b) Effect of flight Mach number at altitude of 25,000 feet.



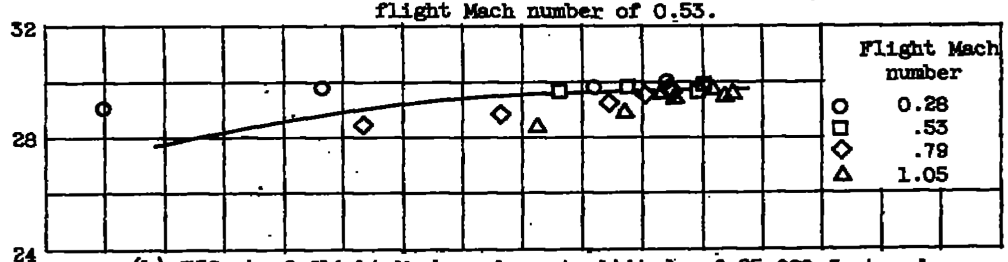
(c) Effect of altitude.

Figure 14. - Effect of corrected turbine speed, exhaust-nozzle area, flight Mach number, and altitude on turbine efficiency.

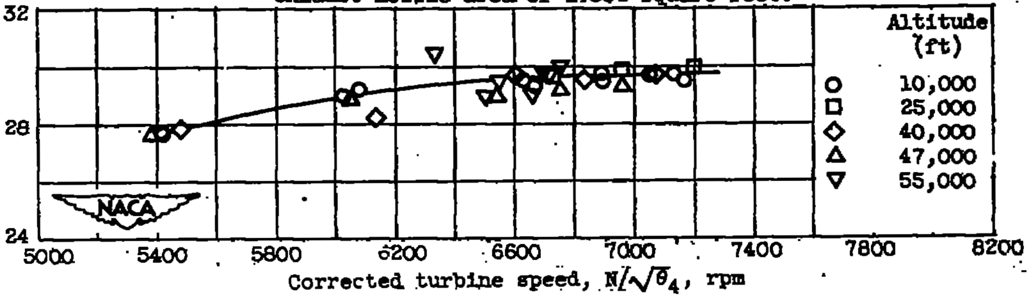
[redacted]



(a) Effect of exhaust-nozzle area at altitude of 25,000 feet and flight Mach number of 0.53.



(b) Effect of flight Mach number at altitude of 25,000 feet and exhaust-nozzle area of 1.334 square feet.



(c) Effect of altitude at flight Mach number of 0.53 and exhaust-nozzle area of 1.334 square feet.

Figure 15. - Effect of corrected turbine speed, exhaust-nozzle area, flight Mach number, and altitude on corrected turbine gas flow.

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[redacted]